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RESEARCH IN PROGRESS
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RESEARCH IN PROGRESS

July, 1924 – July, 1925

The purpose of this Bulletin is to supply a record of investigations carried on at the University of North Carolina during the year ending July 1, 1925. Both faculty and graduate students are included in the record. Publications of a general or popular nature and public addresses of the faculty are omitted. Abstracts of dissertations of candidates for higher degrees are included, both as matter of record and for the information of other persons conducting research in the various fields represented by these essays. At the end of the book will be found programs of the various research organizations of the University, with tables of contents of the research journals published by the University.

The income of the Smith Fund, which became available during the year, has been administered by a special committee of the Administrative Board, of which Professor Harrer is Chairman, with the approval of the Board. A part of this income has been applied to supplementing the Faculty Research Fund, which has been totally inadequate to meet the calls made upon it. Part of the fund has also been applied to defraying traveling expenses of members of the faculty and certain candidates for the doctorate who found it necessary to supplement the library facilities of the University by visits to larger libraries. Aid was also given to one professor who is completing an investigation this summer in Europe, and to one advanced student who is completing his dissertation for the doctorate by work in the British Museum. A statement of the work of the Laura Spelman Rockefeller Foundation in the departments of the social sciences is also appended. A tabulation of research projects by members of the faculty aided by the Faculty Research Fund, and, in certain cases by the Smith Fund, is given herewith.

I am indebted to Dr. James F. Royster, Dean of the College of Liberal Arts, and to Dr. A. C. Howell, Assistant Dean of the Graduate School, for valuable assistance in preparing the material contained in this bulletin.

EDWIN GREENLAW, *Dean.*

Project Number	*Professor*	*Subject*	*Amount*
41	MacNider	Drawings for monographs in research in pharmacology.	$ 15.00
42	Wheeler	Material used in special research on spruce turpentine.	50.00
43	Daugherty	Special apparatus for research in atomic theory.	45.00
44	Greenlaw	Assembling materials, typing and library work, Spenser Edition.	34.00
45	Plyler	Special apparatus for research in light.	110.00
46	Greenlaw	Collecting and transcribing material in Harvard Library.	20.00
47	Pierson	Purchase of special books in Spain.	150.00
48	Metzenthin	Collecting material on "Heliand" in German libraries.	200.00
49	Wheeler	Purchase of material for research in Gossypol.	150.00
50	Couch	Botanical research work at Cold Spring Harbor, L. I.	50.00
51	Mangum	Research work in Harvard University Medical School.	140.00

Three prizes of $50.00 each for research of distinction by graduate students during the year were given from the Smith Fund. They went to:

Languages and Literatures—James Milton Ariail for certain studies in Spenser.

Pure Sciences—James Vernon Harvey for certain studies in water molds.

History and Social Sciences—William Sumner Jenkins, for studies in the organization of political parties.

DEPARTMENT OF ANATOMY

W. C. GEORGE (in collaboration with DR. W. E. HOY, JR., of the Presbyterian College of South Carolina). The Somatic Chromosomes of the Opossums. Elisha Mitchell Scientific Society, January, 1925.

Material used consisted of young opossums about 50 mm. in length. Counts have been made and figures of metaphase plates obtained from several organs of three individuals, one male and two females. The number of chromosomes in somatic cells is 22 for both sexes. The male has the x-y combination of sex chromosomes and the female has the x-x combination. No evidence of fragmentation of chromosomes has been found.

W. C. GEORGE. The Histology of the Blood of Perophora Viridis. Presented before the American Association of Anatomists at Cleveland, Ohio, April 9, 1925.

For abstract see *Anatomical Record,* March, 1925, p. 357; or *Research in Progress,* 1924, p. 5.

DEPARTMENT OF BOTANY

W. C. COKER has completed the following papers during the year:

Revision of the Genus *Thraustotheca,* with a Description of a New Species (with J. N. COUCH). *Journal of the Elisha Mitchell Scientific Society,* 40: 197-202. 1924.

This paper was read before the Botanical Section of the American Association for the Advancement of Science at Cincinnati, December 28, 1923.

Description of a new genus of water molds consisting at present of two species occurring in the soil of Chapel Hill. Also a description of a new species of *Leptolegnia* and one of *Pythiopsis* from the soil of Chapel Hill. The descriptions of the new genus and of the four new species are incorporated in a thesis by Mr. James V. Harvey submitted to the Department of Botany as partial fulfillment of the requirements for the Degree of Master of Arts, Mr. Harvey having found these plants in the course of 200 collections of soil in the neighborhood of Chapel Hill.

The *Gasteromycetes* of the Eastern United States and Canada (with J. N. COUCH).

This book consists of about 250 text pages and includes about 70 half-tone plates from photographs and about 10 plates of drawings of microscopical detail. It is now ready for the press. It includes all known species of puff balls, earth stars, birds nest fungi, etc., occurring in the Eastern United States and Canada.

The following master's thesis was approved by the Department of Botany in 1924-1925:

JAMES VERNON HARVEY. A Study of the Water Molds and Pythiums Occurring in the Soils of Chapel Hill.

During the past few months the writer has isolated many typical water molds from the soil. These aquatic fungi have never before been reported as occurring in the soil.

In 200 collections 118 were found to contain either *Pythium* or species of the *Saprolegniaceae,* and 79 of these contained practically no growths except the water molds.

One interesting new genus, *Geolegnia,* with two species, was isolated. *Geolegnia inflata* was discovered three times; *Geolegnia septisporangia* was found twice. A new species of *Pythiopsis, P. intermedia,* was secured three times. Also a new species of *Leptolegnia, L. subterranea,* was found 11 times.

Of the other water molds, the following species were found: *Saprolegnia ferax* once; *Achlya caroliniana* 27 times, *A. flagellata* 17 times. *Achlya hypogyna* and *A. racemosa* were found once each; *Isoachlya eccentrica* was found five times; *Aphanomyces laevis* was found once and *A. stellatus* was secured three times; *Thraustotheca clavata* was taken seven times; *Dictyuchus* was isolated twice; *Olpidiopsis* was found twice; *Allomyces arbuscula* was found twice. *Pythium monospermum* and *P. deBaryanum* were found 30 and 38 times, respectively.

DEPARTMENT OF CHEMISTRY

JAMES M. BELL has directed the following studies:

HORACE D. CROCKFORD continues his work on the physical properties of the nitrotoluenes, in particuar, their latent heats of fusion.

GEORGE MOSELEY MURPHY has investigated the basic sulfates of copper which exist at 100°. (Master's Thesis, 1925)

On account of the large number of basic copper sulfates of only slightly different composition reported in the literature a study was made of the ternary system, CuO-SO_3-H_2O, at 100° C. in order to see if any definite basic compounds were formed at that temperature. Finely divided copper oxide was allowed to combine with different copper sulfate solutions in order to see what length of time was required for equilibrium; samples were withdrawn and analyzed at different intervals. The values plotted on a smooth curve show that equilibrium is reached after six hours. The equilibrium mixture was analyzed and the results plotted on triangular paper. The tie-lines connecting solution and residues tend to converge at a point representing the compound, $4CuO.SO_3.4H_2O$.

The following conclusions were drawn:

(1) the time for equilibrium to be attained at 100° C. is at least six hours.

(2) since the tie-lines converge at such a small angle, very accurate analysis would be necessary to determine the exact composition of the compound formed. However all the evidence tends to show that it is most certainly $4CuO.SO_3.xH_2O$, with the bulk of the evidence for x to be equal to four. This compound corresponds with a well known basic copper sulfate and with the mineral langite.

LILLIE F. P. CUTLAR has investigated the rapid methods of analysis of mercury in connection with a study of the complex mercury compounds.

ALVIN S. WHEELER and R. W. BOST. (Master's Thesis, 1924)

p-Tolysemicarbazide and Certain Derivatives. *Journal of the American Chemical Society,* 46, 2813, Dec., 1924. See abstract in *Research in Progress* for 1924, p. 14.

ALVIN S. WHEELER and MILDRED MORSE. (Master's Thesis, 1924)

The Chlorination of 2-Amino-p-cymene and Certain New Azo Dyes. *Journal of the American Chemical Society,* 46, 2572, Nov., 1924. See abstract in *Research in Progress* for 1924, p. 16.

ALVIN S. WHEELER and H. M. TAYLOR. (Ph.D. Thesis June 1924)

Para-Cymene Studies V. The Bromination of 2-Amino-p-cymene and Certain New Azo Dyes. *Journal of the American Chemical Society,* 47, 178, Jan. 1925. See abstract in *Research in Progress* for 1924, p. 12.

ALVIN S. WHEELER and F. P. BROOKS. (Progress on Ph.D. Thesis)

The Nitration of 2-Amino-p-cymene.

The amino-p-cymene has been prepared by the reduction of the corresponding nitro compound. The amino derivative was converted into acetyl-amino-cymene by boiling with acetic anhydride. The product is a white crystalline compound. It was found difficult to get it into a crystalline condition, owing to the presence of some impurity, and when it was obtained in crystalline form it underwent a peculiar change. What appeared to be a mold formed over it. Therefore the benzoyl derivative was prepared. But this presented another difficulty. It was almost impossible to hydrolyze it and obtain again the free base. It may be necessary to go back to the acetyl derivative. Nitration cannot be carried out unless one of these derivatives is employed.

ALVIN S. WHEELER and E. DEW. JENNINGS. (Progress on Ph.D. Thesis). The Bromination of p-Cymene.

This work was undertaken to see if any other dibromocymene than the 2,5 form could be obtained. 50 g. of p-cymene cooled by an ice bath was treated with 120 g. of bromine, at the rate of 30 drops per minute, the mixture being constantly stirred. 4 g. of iodine was added as a carrier. The temperature was held at 3-5°. The almost black liquid was washed to a nearly colorless oil with saturated solution of sodium carbonate. The yield was 87% of the theoretical. It was distilled in vacuo at 2 mm. Two fractions were obtained in the ratio of 9:1. The larger fraction boiled at 272° and gave 54.2% bromine on analysis. This product was therefore the 2,5-dibromocymene. The smaller fraction, boiling at 233°, was found to contain 37.32% bromine and was therefore the monobromocymene.

ALVIN S. WHEELER and E. DEW. JENNINGS. Gossypol.

Gossypol was obtained by the Carruth method, extracting the oil from the cotton seed with gasoline and then extracting the gossypol with ethyl ether. The crystalline acetate, melting at 155°-162°, was prepared. The gossypol was purified by recrystallizing from a mixture of ethyl ether and petroleum ether. It melted at 184°-186° but it began to darken at 170°. On boiling with alcohol a part went into solution. The residue melted at 212°-216°; whereas that part which dissolved crystallized out on cooling and melted at 190°-200°. This indicated a separation of two compounds or a reaction with alcohol. A molecular weight determination of gossypol was not made since no suitable solvent could be found. An analysis for carbon and hydrogen gave: C, 69.58% and 69.54%. H, 6.22% and 6.05%.

ALVIN S. WHEELER and C. R. HARRIS. (Progress on Ph.D. Thesis)

The Nitration of p-Cymene. 2-Amino-6-nitro-p-cymene and Its Derivatives.

A study was first made of the nitration of cymene to determine the best method to prepare the 2,6-dinitrocymene. The latter had previously been made by Afthan and others. The best results were obtained by dropping cymene into a well stirred mixture of fuming nitric acid, 1.5, and four parts of sulfuric acid, 1.84, keeping the temperature below 0°. A 34% yield was obtained. Nitrocymene, under the same conditions but using only one-half as much acid, gave a yield of 38%. The nitration product was a viscous liquid from which on cooling the dinitrocymene crystallized out along with some 2,4-dinitrotoluene. These products were separated by using a mixed solvent, one part of carbon tetrachloride and four parts of petroleum ether, in which the dinitrotoluene is but slightly soluble.

On reduction of the dinitrocymene with ammonium sulfide the nitroaminocymene was obtained, crystallizing from alcohol in bright yellow needles, melting at 52°. Acetic anhydride gave an acetate, melting at 115°. The benzoyl derivative, long white needles, melted at 179°. A series of dyes is

being prepared by diazotizing the amine and coupling it with various phenols and amines.

ALVIN S. WHEELER and B. G. CARSON. (Progress on Master's Thesis) The Bromination of Naphthazarine.

The bromination of naphthazarine in boiling glacial acetic acid gives, after six hours, a tetrabromide, a bronze-colored compound, melting at 299°-300°. No higher bromide can be obtained by this method. The reaction if carried out in the cold requires about four weeks. A diacetate, lemon yellow crystals, melting at 241°, was obtained, showing the presence of two OH groups. It was found impossible to reduce the tetrabromide. All of the usual reducing agents were tried in vain. Sodium sulfite produced a change but no product could be isolated. The tetrabromide boiled with aniline in alcohol solution gave a bronze-colored aniline derivative, melting at 247°. m-Nitroaniline gave a derivative also. A sodium salt of the tetrabromide was prepared and this, boiled with ethyl iodide, gave an ethoxy derivative. Attempts were made in vain to replace one or more of the bromine atoms with hydroxyl.

ALVIN S. WHEELER and T. T. WALKER. (Master's Thesis, 1925) 4-m-Nitrophenyl-semicarbazide and Certain Derivatives.

This compound was prepared by boiling for fifty hours in a reflux condenser a mixture consisting of three molecules of 100% hydrazine hydrate to one molecule of m-nitrophenyl urea in absolute alcoholic solution. The reaction took place with the freeing of a molecule of ammonia and one of water and the formation of 4-m-nitrophenyl-semicarbazide, thus:

$$NO_2C_6H_4NHCONH_2 + NH_2NH_2H_2O = NO_2C_6H_4NHCONHNH_2 + H_2O + NH_3.$$

The m-nitrophenyl urea was prepared by treating m-nitranilin in glacial acetic acid solution with an excess of finely divided potassium cyanate, then pouring the mixture into a large volume of cold water which precipitated the crude product. It was purified by recrystallization from boiling water and consisted of light yellow needles melting at 187-194° C.

The 4-m-nitrophenyl-semicarbazide was purified by converting it into its hydrochloride and reprecipitating it with potassium hydroxide and then recrystallizing it from hot 95% ethyl alcohol. It was obtained in the form of fine, flexible, pale yellow needles which melted at 138-139° C. This substance reduces Fehlings solution, also ammoniacial silver nitrate solution even when cold.

The hydrochloride was prepared by treating the substance in hot ethyl alcohol solution with concentrated hydrochloric acid and was obtained in the form of white flake-like crystals.

The following derivatives of 4-m-nitrophenyl-semicarbazide were prepared: (A) Acetone-4-m-nitrophenyl-semicarbazone, light yellow needles, melting at 210-211° C., recrystallized from alcohol. (B) Methyl-ethyl ketone-4-m-nitrophenyl-semicarbazone, pale yellow needles, melting at 205° C., recrystallized from alcohol. (C) Acetophenone-4-m-nitrophenyl-semicarbazone, fine white needles, melting at 211-212° C., recrystallized from benzol. (D) Benzophenone-

4-m-nitrophenyl-semicarbazone, light yellow needles, melting at 133-136° C., recrystallized from alcohol. (E) Camphor-4-m-nitrophenyl-semicarbazone, colorless, very short and thick prisms, melting at 240-242° C., recrystallized from alcohol. (F) Cyclohexanone-4-m-nitrophenyl-semicarbazone, colorless needles, melting at 219-220° C., recrystallized from alcohol. (G) Chloracetone-4-m-nitrophenyl-semicarbazone, pale yellow needles, melting at 238° C., recrystallized from alcohol. (H) p-quinone-4-m-nitrophenyl-semicarbazone (?) brown needles, melting at 202-203° C. This substance was so insoluble that it could not be purified; it was not analyzed. All of these compounds are extremely bulky. These compounds are all new substances.

FRANK C. VILBRANDT with E. V. KYSER. Some Critical Points of Emulsification in Oil-Soap Emulsions. *Journal American Pharmaceutical Association,* Vol. XIV, No. 5, p. 392, May, 1925. (Abstract appears on page 63.)

FRANK C. VILBRANDT and W. E. GILES. (Progress on Ph.D. Thesis)

This year a continuation of the low temperature distillation studies was carried out on the shale deposits of the Deep River Valley. A correlation of low temperature distillation of the coals and nearby shales of this region will be made with eastern petroleums.

Professor VILBRANDT presented the following papers:

North Carolina Shales. Given before the North Carolina Academy of Science, Raleigh, N. C., May 2, 1925.

The paper presented the evidences of oil-bearing shales in the Deep River Valley, the extent of the deposits, yields of shale oil and ammonium sulfate and the economies of this shale.

Recent Developments in Chemical Industries in North Carolina, Raleigh, N. C., May 2, 1925. N. C. Section of the American Chemical Society.

A statistical review of advancements and retrogressions occurring among the chemical industries of the state.

PROFESSOR VILBRANDT assisted in preparing the following papers read by students at Raleigh, N. C., May 2, 1925. N. C. Section of the American Chemical Society.

1. The Evaluation of Lubricating Oils—R. M. Byrd.
2. Oxidation of Sulfur Dioxide with Potassium Permanganate—H. A. Dickert.
3. E. M. F. Studies of Battery Metals—R. R. Suggs.
4. Determination of Phosphorus in Steel—W. M. Mebane.
5. The Chemist in the Laundry—W. C. Quinby.

PROFESSOR VILBRANDT has the following investigations under way:

1. Manufacture of Bricks from North Carolina Clays (with R. A. Lineberry).
2. Storage Battery Metals (with R. R. Suggs).
3. Determination of Phosphorus in Steel (with W. M. Mebane).
4. Stability Tests for Lubricating Oils (with R. M. Byrd).
5. New Vegetable Oil Lubricant (with R. M. Byrd).
6. Further Studies of North Carolina Shales.

F. C. VILBRANDT and R. M. BYRD. The Instability of Lubricating Oil. (Master's Thesis, 1925)

The object of the experiment was to investigate the instability of lubricating oil and to try out a new carbon spot test, which we propose as a better means of determining the instability of oil than the methods that are now being used.

The following physical constants were determined along with the new carbon spot test on a number of different brands and grades of oil: Specific gravity, viscosity, flash point, fire point, unsaturation, Conradson residue test, demulsibility, and emulsion tests.

The carbon spot test was made by heating a definite quantity of oil in a Cleveland open cup flash point tester until the fire point was reached. Then it was cooled down and filtered through a weighed gooch crucible. The mat was washed thoroughly with gasoline, dried and weighed. From the values obtained, the instability of the oil was determined.

The conclusions reached were that the new carbon spot test as proposed is a better test for determining the instability of an oil than the Conradson test which is now being used. The actual operating conditions of an engine are more closely met with by the carbon spot test than with the Conradson test. The apparent viscosity of an oil does not afford much information as to its lubricating power because at the temperature of lubrication of an engine, the viscosity of all grades of oil is practically the same.

FRANK C. VILBRANDT and HERMAN ALONZO DICKERT. Oxidation of Sulphur Dioxide with Potassium Permanganate. (Master's Thesis, 1925)

The object of this study was to determine the chemistry of the $KMnO_4$-SO_2 reaction. A review of the literature is given in which it is shown that there is a great difference of opinion as to the products that are formed in the reaction. The authors thought it possible that all the oxidation products might be formed; so the sulfides, sulfites, thio-sulfates, sulfates and dithionates were determined. These determinations were carried out under all possible conditions as follows:

a. Changing SO_2 concentration.
b. Changing $KMnO_4$ normality.
c. Using acid solution of $KMnO_4$, varying the amount of acid used.
d. Using alkaline solution of $KMnO_4$, varying the amount of alkali used.
e. Changing the temperature of the solution.

It was found that the accepted equation for the $KMnO_4$-SO_2 reaction is incorrect and that under certain conditions sulfides, sulfites and dithionates are formed, together with sulfates and thiosulfates.

The concentration of the SO_2, $KMnO_4$ and the acid and alkaline solutions as well as the change in temperature affect the oxidation, but under all conditions dithionates tend to form showing that all is not oxidized completely to sulfates.

F. C. VILBRANDT and R. ARTHUR LINEBERRY. A Manufacturing Study of North Carolina Brick Clays. (Master's Thesis, 1925)

The object of this investigation was to study the quality, workability, and utility of many of the North Carolina clays. (1) The physical properties of the clays were studied; (2) the clays were subjected to variations in grinding, "ageing", firing, rate of cooling, etc., with the purpose of making a scientific study of the brick so obtained.

Tests were carried out on the unground clay and the 20-,40-,60-, and 100-mesh grind. The "ageing" was carried out under three conditions: (1) "ageing" at saturation at 76° C.; (2) "ageing" at atmospheric conditions at room temperature; (3) "ageing" at saturation at room temperature. The "ageing" was continued for three months. The brick were burned for one and five hours at 950° C. The rate of cooling was fast and slow.

The following conclusions have been drawn from the results obtained in this investigation:

1. North Carolina clays under proper conditions of grinding, "ageing," firing, and rate of cooling, can be made into first-class brick.
2. The grinding of clay greatly increases its plasticity and workability.
3. The "ageing" of clay at saturation at 76° C. gave the best results in that the brick could be heated up faster and were less likely to break during burning.
4. Brick made of ground clay were found to be less likely to crack during drying and burning; whereas in nearly every case brick made of unground clay cracked during drying and more during the burning.
5. Clay ground to 60 mesh gave the best results.
6. In so far as this investigation has been carried out, "ageing" has no appreciable effect on the absorption and porosity tests.
7. Brick cooled slowly show less cracks, but the rate of cooling has no appreciable effect on the porosity and absorption tests.

DEPARTMENT OF CIVIL ENGINEERING

G. M. BRAUNE is directing a series of experiments on a large scale to determine the vertical earth pressure on culvert pipes. The work is conducted jointly by the North Carolina State Highway Commission and the School of Engineering. These experiments will be continued for probably two or three years longer and not only will include the

determination of actual earth pressure but will also attempt to correlate these results with the carrying capacity of culvert pipes. Up to the present time data have been obtained on sand fills up to 20 feet in height and clay fills up to 12 feet in height. Associated with Dean Braune are H. Cantey and H. Mc. Holmes, in consultation with Dr. William Cain.

The general method being used to determine the pressure is as follows: Four two-and-one-half foot sections of thirty-inch cast iron pipe were placed on columns resting on the weighing platforms of specially designed scales. The scales and columns were housed in a concrete culvert, in the top of which there was a slot just large enough to admit the pipe, which lay in a horizontal position, with one half of its surface protruding above the top of the culvert and exposed to the pressure of the earth fill, while the other half of its surface was inside the culvert resting on the top of the column.

A sand fill, of a uniform quality of sand, was built up on one-foot layers, each layer being carefully leveled off and the pressure accurately determined by weighing the loads on the various scales. An attempt was made to roll the sand fill, but it was not found to be practical. The experimental fill with sand was carried to a height of 20 feet above the top of the pipe. The sand fill was now removed and replaced with a clay fill. This fill was also placed in one-foot layers and readings taken at each foot level similar to the method employed with the sand fill. The clay fill was rolled with a four-ton roller and carried to a height of 14 feet. The next part of the experiment as proposed will consist of using a clay fill and laying the pipe in a trench condition. It is believed that by laying a pipe in this manner the pressure exerted on it by the fill is lessened. The curve as plotted shows the results of the work to date. It is interesting to note that the clay fill produces considerably more pressure on the pipe than does the sand fill.

In connection with this work a series of experiments by research fellows, H. Cantey and H. McC. Holmes, is being conducted under the direction of DR. WILLIAM CAIN to determine the coefficient of expansion of certain metals.

THORNDIKE SAVILLE and R. S. DEARSTYNE have continued the first investigation of stream pollution to be made in North Carolina. The streams being investigated are Little and Moccasin Creeks in Wake County, which receive the sewage from the town of Zebulon. Studies of Total Bacteria, Fecal and non-Fecal B. coli, Protozoa, Bio-Chemical Oxygen Demand and Dissolved Oxygen are being made at a number of sampling stations. The investigation will be carried through two years, making semi-monthly analyses.

THORNDIKE SAVILLE and G. WALLACE SMITH have completed a Bul-

letin on Stream Flow in North Carolina, to be issued by the North Carolina Geological and Economic Survey. This is in press and will be the most detailed and comprehensive report of its kind ever issued by any state.

THORNDIKE SAVILLE and J. B. PADGETT have been making studies of Floods on North Carolina Streams by Probability Methods. All streams in the state for which discharge records of ten years or more exist have been investigated. The results will be published.
THORNDIKE SAVILLE and C. C. BABB have begun a detailed study of stream flow by the methods of probabilities, with especial reference to North Carolina streams.

THORNDIKE SAVILLE has been carrying on an investigation of silting in reservoirs and behind navigation dams as Chairman of a Committee on Silting of the American Society of Civil Engineers. The Committee is coöperating with the French Hydro-Technical Society in a world-wide study of the subject, and in this country is being assisted by the Corps of Engineers of the United States Army in studies of silting behind navigation dams on the Ohio River.

THORNDIKE SAVILLE, with O. E. MARTIN and G. WALLACE SMITH, has carried on a Water Power Investigation of Dan River in Stokes County for the Department of Conservation and Development.
THORNDIKE SAVILLE, with RALPH M. TRIMBLE and a party of students from the Engineering School, is conducting a Water Power Survey of New River in Ashe, Alleghany and Watauga Counties for the Department of Conservation and Development.

THORNDIKE SAVILLE has published:

Water Power Investigation of Deep River. *North Carolina Geological and Economic Survey.* Economic Paper 54, Raleigh.

The Power Situation in North Carolina. 1919-1923, *North Carolina Geological and Economic Survey,* Circular 10, Raleigh.

T. F. HICKERSON has completed the following study:

Vertical Curves of Greater Flexibility for Railroads and Highways: A New Method.

Vertical curves are necessary for roads and railroads where there is an abrupt change in the gradient whether it be in and out of a ravine or over a hill. The parabola whose offsets vary as the square of the distance has been universally used for these curves. It gives a rather pleasing vertical profile

and has the advantage of simplicity. For grades as flat as those usually occurring in practice, the ordinary parabola really coincides almost exactly with a circular arc.

Although the parabolic or circular arcs are satisfactory curves for most cases, yet they do not afford the flexibility which is often desirable, especially in the case of railroad and highway grade crossing eliminations, where in a limited distance the offsets should vary *faster* or *slower* than the square of the distance.

The curve adaptable to any case of vertical alignment is a parabola whose general equation is

$$y = \left(\frac{x}{l}\right)^n E \quad \ldots\ldots\ldots \quad (1).$$

The equation of the ordinary parabola is

$$y = \left(\frac{x}{l}\right)^2 e \quad \ldots\ldots\ldots \quad (2).$$

where $2l$ = total length of parabolic curve; E or e = central offset from tangent to curve.

If both curves have the same origin and parallel tangents at the central points (where x = l), then equating the first derivative of equations (1) and (2) we have

$$\frac{dy}{dx} = n\left(\frac{l}{l}\right)^{n-1}\left(\frac{1}{l}\right)E = 2\left(\frac{l}{l}\right)\left(\frac{1}{l}\right)e;$$

$$\therefore n = \frac{2e}{E} \quad \ldots\ldots\ldots\ldots \quad (3)$$

By giving E various values ranging from .5e to 1.5e and differing by 0.1e, a set of parabolic curves is obtained which has central offsets more or less (as the case may require) than that of the usual parabola. Thus, if it is desired to have a central offset = 1.2e, a parabola whose equation is

$$y = \left(\frac{x}{l}\right)^{1.67} \text{ is suitable.}$$

Tables have been compiled by the writer giving offsets to all points of any curve whose equation is $y = \left(\frac{x}{l}\right)^n$ for values of n ranging from 1.33 to 4.0. Thus, if a + 6% grades meets a — 4% grade at a point where space is available for a vertical curve 400 feet long (200 feet on either side of the point of intersection);

$$l = 200 \text{ feet,}$$

$$e = \frac{l}{4}\left(\frac{6-(-4)}{100}\right) = 5.0 \text{ feet} = \text{central offset for ordinary parabola.}$$

Now if it is desirable to make the elevation of grade at the center of the curve 2 feet lower than that given by the ordinary method, for obtaining a more extensive unobstructed view over a hill or for allowing greater head room under a railroad, then with $n = 2 \times \frac{5}{7} = 1.43$ (formula 3), it is only necessary to refer to the proper table for offsets defining the appropriate curve.

DEPARTMENT OF CLASSICAL LANGUAGES AND LITERATURES

G. A. HARRER has published:

The Site of Cicero's Villa at Arpinum, in *Studies in Philology,* October, 1924.

The Traditional Site of Cicero's Tusculanum, in *The American Journal of Archaeology,* 1924.

He has completed a study on The New Latin Inscription from Antioch—a study of an inscription published in the last issue of the *Transactions of the American Philological Association,* by D. M. Robinson. He is finishing work on a supplement to W. Liebenam's *Fasti Consulares Imperii Romani,* and has begun work on a translation and edition of Liudprans's *Relatio de Legatione Constantinopolitana,* a narrative from the tenth century.

DEPARTMENT OF ECONOMICS AND COMMERCE

D. D. CARROLL has spent the year in study and travel in Europe on a Kenan Travelling Professorship. He visited England, France, Germany, Italy, Austria, and Czecho-Slovakia, paying special attention to economic conditions and the methods of training for business in the higher educational institutions.

WALTER J. MATHERLY completed at mid-year: The Evolution of Personnel Management. This study has been accepted for publication by the *Industrial Management Magazine.*

This study traces the development of personnel work from its beginnings in medieval industry to the present time. It shows how so-called welfare work developed, how the concept of the human factor in industry gradually evolved, and how personnel management based upon scientific knowledge came into existence about the second decade of the twentieth century.

PROFESSOR MATHERLY has just completed a study in the Emergence of Factory Labor.

This study discusses the historical background of factory labor. The emergency of factory labor is traced through the following periods: the period of the slave, the period of the serf, the period of the free artisan, and the period of the modern factory worker.

WILLARD E. ATKINS completed for publication his book on *Labor Problems and Attitudes* (Prentice-Hall, pp. 520, 1924).

MOSES K. HEARNE has started research in municipal accounting systems, restricting his attention at present to the smaller municipalities of North Carolina.

The following Master's Theses were accepted by the Department during the year:

THERA EARL HINSON. Economic Development of Branch Banking.

Correct judgment as to the legal and economic desirability of branch-banking in the United States is particularly difficult for three reasons: 1, the division of our banks into two classes according to type of jurisdiction—State banks and National banks; 2, the lack of harmony in the banking legislation of the various states; 3, the extreme variations in social and economic conditions inevitable in a country so broad territorially as ours and so young.

Historically, our experience with branch-banking covers a long period, but has been sporadic. The First Bank of the United States, 1791-1811, operated seven branches; the Second Bank of the United States, 1816-1836, operated at one time as many as 18 branches distributed among all of the important commercial cities of the country.

But the National Bank Act of 1863 made no express provision relative to branches. Inferences drawn therefrom, however, by the Comptroller and the Attorney General have in general been adverse. Despite this, many National banks are to be found with branches, the presence of which may usually be explained in one of the following ways. National banks that were formerly State banks have continued to operate branches acquired under State charters. Some National banks have consolidated with State banks, retaining whatever branches the State banks may have had. Stockholders of National banks have acquired control of State banks. Recently in some instances the consent of the comptroller has been gained to the establishment of a narrow type of branch, in effect nothing more nor less than a "teller's window," provided such branches were located in the same city with the parent bank.

As between the states the legal status of branch banks is highly confusing. In twenty-seven states branches are to be found operating with more or less freedom; in twenty-one they are directly or indirectly prohibited.

In this treatise the economic issues have been marshalled in three classes as they relate to: branch-banking on the side of efficiency in the performance of immediate banking functions; branch-banking on the side of the immediate community interest involved; the operation of the banking system as a whole in connection with a program of national, as distinct from local, economy.

In general the study leads to the conclusion that the use of branches in many instances increases the efficiency and profitableness of banking. However, from the standpoint of community interest branch-banking has many serious draw-backs. It should be carefully restricted by Federal and State law.

S. N. A. ALAGAPPA MUTHIAH. Some Economic Aspects of Jute Production and Trade with Special Reference to American Interests.

Jute is the bast fiber from which the bulk of the wrapping cloth of modern commerce is made. Major crops of the world such as cotton and sugar as well as large quantities of manufactured goods move about the globe wrapped in materials made from jute. They depend on jute for their orderly marketing; their price is affected by that of jute.

In sharp contrast to this world-wide importance and universal usefulness of jute is the geographical limitation of its production which is almost entirely confined to certain favored sections of India. Such a situation is pregnant with danger. Ipso facto those who depend on jute for the disposal of their wares must view with alarm a natural monopoly in the production of such a necessity. The United States is the biggest consumer of jute products. The assured continuity, therefore, of our jute supply is a matter of grave concern to us.

By using not only American and English, but also Indian sources of information, a study was made into the conditions affecting jute production and jute manufacture. An attempt was made to trace the world jute supply not only through the agricultural stage, but also through the commercial and industrial phases with special emphasis upon factors determining cost of producing and handling. It was found that Bengal's jute-producing monopoly is based on natural as well as social conditions, not existing anywhere else in the world in a like or similar combination; that sound economic forces are attracting to Calcutta an ever increasing share of the jute-manufacturing industry of the world; that the United States confines itself to the manufacture of cotton bagging and imports the remainder of its requirements directly from India and, to a decreasing extent, from England and Scotland.

No discrimination against the United States was discovered. Attempts on the part of British industry to secure for itself a privileged position or preferential treatment seem to have failed.

Special attention is given to the possibility of substituting other fibers in case of a jute scarcity and to the problem of our future jute supply. It was found that jute production is capable of considerable expansion under an adequate price stimulus. In conclusion it is stated that "the supply of jute seems reasonably assured for the near future, on terms satisfactory to all parties concerned."

WILMER CARR PRESNELL. The Peach Industry of North Carolina.

The peach industry is a new development in the economic life of North Carolina. The purpose of this thesis is to analyze this industry. The analysis is concerned primarily with discussing the origin and growth of the industry, and setting forth the economic problems facing the growers.

There has been an enormous expansion of the industry since 1918 and many complicated problems have arisen as a result. Upon examination it is found that the Sandhill peach industry has not been profitable since 1920 due

primarily to nation-wide over-production; and in addition, there has been increasingly poor coöperation among the growers themselves.

Marketing machinery has not developed as fast as production and as a result the problems are increasing and yearly becoming more aggravated in nature. Assuming the same ratio of output to bearing trees in 1928 as was secured in 1924, the new trees coming in will increase the Sandhill production from 1,474 cars in 1924 to 6,000 - 9,000 cars in 1928. This period will be a crucial period for the industry.

The Sandhills have an advantage in soil, climate, nearness to markets, and in a cheap labor supply that few other peach sections possess; but considering the over-expanded condition of the industry and the nature of the product itself it is apparently a question of merely being able to wait until production adjusts itself to demand conditions over the country as a whole.

CHARLES GORDON REEVES. Current Economic Fallacies.

This is a study of the causes and of the perpetuation of economic fallacies as found in current magazines and newspapers. These causes are varied, but, in the main, they may be attributed to two major factors of our present society which serve as fountain heads for originating and lending support to such fallacies. These factors are: 1, the failure to think of economics as an evolving science, a fact which is shown by the influence exerted by habits, customs, traditions, conventions, and laws, when economic problems arise and demand solution; 2, the influence which vested interests have and use to further their own selfish ends. This is shown by the policies and attitudes of newspapers which these interests control and also by their political activities.

Attention is also given to some minor, though important, factors of our society which, by restricting the range of the individual's thoughts, produce fallacious reasoning upon economic problems. Excessive loyalty to a nation, a political party, a labor union or to anything, in fact, prevents one from having a broad point of view. The conclusions arrived at are warped by personal prejudice. The use of stereotypes in our thinking handicaps analytic thought upon any social phenomenon. Specialization is conducive to the origin and growth of economic fallacies for two reasons: 1, the necessity of concentrating all of one's efforts in a particular field prevents an intelligent grasp of the general working of our society as a whole; 2, it seems difficult for the specialist to confine his opinions to the particular field in which he is more or less of an expert. Such opinions may have considerable influence because of the reputation of the specialist. It seems that the public fails to realize that one may excel in a particular field of endeavor and yet be quite ignorant of other fields. The difficulty of securing facts is also responsible for much fallacious reasoning with regard to economic questions. This difficulty is attributable to two causes: 1, the inadequacy of the agencies for collecting these facts; 2, the activities of vested interests in concealing and distorting facts.

Examples of the fallacies discussed appear wherever necessary

DEPARTMENT OF EDUCATION

EDGAR W. KNIGHT is making an intimate first-hand study of the *Folk High School in Scandinavia,* and is on leave of absence on the Kenan Foundation for that purpose. The results of his study will be published in 1926.

MR. KNIGHT is completing his study of *The Influence of the Labor Movement on Education in the United States,* reported last year as under way. He is also directing the following studies:

R. L. TREMAIN: The Development of the County Board of Education in North Carolina.

W. R. SCHAFF: The Progress and Present Problems of Education in Buncombe County.

L. R. CASEY: The Influence of the Quakers on Education in North Carolina.

THE BUREAU OF EDUCATIONAL RESEARCH was organized on July 1, 1923, without appropriations for the expenses or publication of research work, but with the understanding that such appropriations would be made available two years later. The work thus far accomplished has been done by the director and his assistant, Miss Viele, and by an occasional graduate student who had the ability and was able to devote some time to the scientific investigation of educational problems. Many other simple investigations have been conducted by superintendents and supervisors throughout the state, often from plans and materials furnished directly by the Bureau, but as yet it is not fair to say that the Bureau has begun its work. Several thousand dollars worth of testing materials are being supplied to the schools of North Carolina each year.

M. R. TRABUE has been requested to prepare and standardize a test in French composition for The Modern Foreign Language Study, which is now being conducted under the auspices of the American Council on Education. The chairman of this investigation, Professor R. H. Fife of Columbia University, has appointed one hundred teachers and authorities in French in the schools and colleges of the eastern part of the United States to assist Mr. Trabue in this study. The completed scale is to be ready for general use by January 1, 1926.

M. R. TRABUE has been asked by the President of the American Association of Medical Colleges to prepare a report on the improvement of examinations for presentation at the next convention of this association, which will be held at Charleston, S. C., in October, 1925.

At the Washington, D. C., meetings of the American Association for the Advancement of Science, MR. TRABUE read a paper before Section Q on "Special Applications of the Scientific Method to Educational Measurements." This paper was printed in full in *School and Society*. (Vol. XXI, No. 539, April 25, 1925, pp. 1-6.)

M. R. TRABUE directed the following research projects which have been completed during the past year:

C. R. BIRD. The Advantages of Rural School Consolidation in North Carolina.

This was an analysis and summary of the literature of school-consolidation during the past twenty-five years in North Carolina.

W. E. BIRD. Changes in Curricula of State Normal Schools Accompanying the Addition of Third-and-Fourth-Year Work.

This study involved the collection and analysis of curricula in state normal schools at two different periods: (a) before third- and fourth-year work were added and (b) after the two additional years were added. Comparisons of the curricula announced in the catalogues for the two periods were supplemented by direct correspondence with the heads of the schools concerned. The most important finding of the investigation was that the lengthened period of study was accompanied by very little enrichment of the subject matter. In general the work which had been accomplished previously in two years was spread over four years, with the addition of a somewhat larger amount of academic work.

GROVER MORGAN. Mental Tests in a Small College. (Published in *The North Carolina Teacher,* Vol. I, No. 7, March, 1925, p. 201 ff.)

In this study President Morgan of Summerland College reported the coefficients of correlation found between the intelligence test scores of freshmen and the grades assigned the same students for various studies in Lenoir-Rhyne College over a period of two years. The Dearborn Group Tests, General Examinations C and D, were clearly superior to the Otis Self-Administering Tests of Mental Ability during the period and with the pupils considered. The general validity of the Otis tests was indicated by a coefficient of .20, while for the Dearborn tests the corresponding coefficient was .44, which agrees almost exactly with the relationship found for university freshmen, reported in this bulletin last year by T. A. Whitener.

L. R. SIDES. A Study of High School Scholarship Marks. (Published in *The North Carolina Teacher,* Volume I, No. 7, March, 1925, p. 196 ff.)

This investigation involved the rating of an examination paper in English by 63 teachers of first-year English in the accredited high schools of North Carolina, the rating of a general science examination paper by 65 teachers of general science, and the rating of a mathematics paper by 62 teachers of first-year mathematics. Each of these teachers rated the mimeographed examination paper in the manner employed with similar papers from his own pupils and sent the mark to Chapel Hill before consulting with anyone regarding it. The greatest difference of opinion was with regard to the paper in general science, which was rated at 37% by one teacher and at 98% by another. The closest agreement was with regard to the English paper, which was rated at 54% by one teacher and at 93% by three others. Mr. Sides summarized the study by the statement that "scholarship marks as they are now assigned are not very safe predictions of the marks the next teacher will give for the very same grade of work."

ADA B. VIELE. A Comparative Study of Four Primary Mental Tests. (Published in *The Elementary School Journal,* Vol. XXV, No. 9, May, 1925, pp. 675-681.)

The so-called intelligence tests have been used for several years in many schools as at least a partial basis for the classification of pupils. The first grades of the elementary school have seemed the most logical place for the use of such measures, and many different tests have appeared on the market for classifying primary-grade pupils. This investigation was an attempt to determine which of four commonly-used mental tests is most valid under ordinary classroom conditions.

Eight first-grade classes and five second-grade classes in the Roanoke Rapids schools were examined by means of the four tests, and coefficients of correlation were calculated between the estimates of the pupils made by their teachers and the scores made by the pupils on the tests, and also among the test scores themselves. In general the Dearborn Group Test, Series I, showed a slight superiority to the other tests in the matter of the validity of the scores obtained, but the Pintner-Cunningham Primary Mental Test was almost as satisfactory and required very much less work in its administration and scoring. The Cole-Vincent Test for School Entrants and the Detroit First-Grade Intelligence Test were only a few points lower in their average correlations than the two mentioned above.

ADA B. VIELE. A Study of the English Achievements of Some North Carolina High School Students in 1923-1924.

All of the pupils in forty North Carolina high schools were tested during the school year 1923-24 by means of the Thorndike Test of Word Knowledge, the Thorndike-McCall Reading Scale, the Hudelson Typical English Compo-

sition Ability Scale, and the Briggs English Forms Test. All of the pupils in two counties and in a few other schools were also tested by the Miller Mental Ability Test. In all more than two thousand first-year pupils were tested, thirteen hundred and fifty second-year pupils, eleven hundred third-year pupils, and eight hundred fourth-year pupils. The results of this study supply for the first time a definite knowledge of just how the high school pupils in North Carolina compare in their achievements with pupils of the same grades in other states. They also supply information regarding the wide differences among the various high schools within the state.

Some high schools in North Carolina obtain better results in English from their freshman classes than other schools obtain from their senior classes. Within the same recitation section in English there are frequently pupils who have abilities ten or a dozen years ahead of other members of the class. In the results they achieve the high schools of this state are what might be called "spotted." The difficulty is that there are too few high spots and too many low spots. The same material equipment and number of pupils does not bring about equally satisfactory results. This study further reveals many of the specific defects which English teachers need to correct in their pupils. It also indicates the need for longer school terms in the elementary grades and for other administrative reorganizations.

ADA B. VIELE. Some Educational Achievements of High School Pupils in Forsyth County.

During the month of April, 1925, the high school pupils of Forsyth County (outside of Winston-Salem) were given standard tests in the following fields: spelling, English vocabulary, English forms, general science, algebra, Latin forms, and French translation. The results of these tests were tabulated and presented to the county board of education with specific suggestions for the improvement of the situations revealed. If the results from these schools in Forsyth County are typical of North Carolina rural high schools, there is need for some effective method of prohibiting the establishment of many of the smaller high schools which are unable to provide the educational advantages which the patrons assume they are receiving.

M. R. TRABUE. The Effect of Music upon the Ability to Coördinate.

This report deals with a study of the coordination scores of 60 students. These students were given the Dunlap form of the Johns Hopkins Coördination Test twice—once while they were keeping time to late dance records and about three months later when the same records had become very familiar to them. In addition a comparison was made with a metronome operated at the same rate as the music.

The scores on the Coordination Test with music were somewhat better than those without the music but this difference seems to disappear with increasing familiarity of the music.

W. O. HAMPTON. A Survey of the Sylva Public Schools. (Master's Thesis, 1925)

This investigation was an attempt to measure and evaluate the public school system of a western North Carolina mountain town, and on the basis of the needs and the adequacy of the provisions discovered to propose a program of development that would care for the educational needs of the community.

The sites and buildings were evaluated by means of the Strayer-Engelhardt Score Card for School Buildings, and a program of repairs, replacements, and additions was proposed. The achievements of the pupils in the elementary grades were measured by means of recognized standard tests. Certain deficiencies in the skills, knowledges, and appreciations of the pupils were located, attempts were made to discover the causes of these defects, and remedial measures were proposed. In general the pupils seemed to have adequate mental ability to do school work, but their actual achievements in certain school subjects were found to be very low, suggesting that their instruction had been inadequate in quantity or in quality. The situation with regard to attendance and health was studied and their bearings on the achievements of the pupils were pointed out.

The problems of securing adequately trained teachers, consolidating small neighboring schools, and organizing an efficient system for educating all the pupils of the community were discussed in the light of the facts collected in this investigation. The costs per pupil for various educational activities in Sylva and in the neighboring schools were calculated, and proposals were made for the adoption of more adequate systems of securing and accounting for school funds.

R. F. MARSHBURN. Some Results of High School English Instruction in Warren County. (Master's Thesis, 1925)

This investigation was a part of the study reported above for 1923-24 by Miss Viele. The facts regarding Warren County pupils were interpreted graphically to show comparisons with other counties and with the corresponding grades in other states where the same tests have been given. Detailed comparisons among the four high schools in Warren County showed a distinct superiority in the results being obtained in Warrenton, which may be attributed to the longer school term and to the higher cultural standards that have prevailed for years in this town. The seriousness of the situation caused by small schools attempting to do high school work was brought out clearly in several places in this investigation.

Among the research projects now under way are the following:

R. W. ADAMS. Comparative Costs of Various Types of School Buildings.

MINNIE ATKINSON. Present Status of Physical Education for Girls in North Carolina High Schools.

J. H. FLOYD. Intercorrelations of English Abilities among Pupils in Rural High Schools.

WINIFRED INGOLD. Analysis of the Types of Errors in English made by Pupils in the High Schools of Forsyth County.

H. D. PEGG. English Abilities of High School Pupils in Montgomery County.

W. G. PRIVETTE. A Survey of the Students in Teacher-Training Institutions.

M. R. TRABUE. A Standard Test of Ability to Judge English Prose.

F. M. WATERS. The Educational Achievements and Capacities of Mill Workers.

D. P. WHITLEY. Influence of Ability on Choice of a College.

A. M. JORDAN has carried on the following studies during the year:

Mental, Physical, and Educational Growth of School Children in a Mill Village Community.

This piece of work was made possible by a grant from the Laura Spelman Rockefeller Foundation to the University of North Carolina. W. D. Glenn has been engaged in the actual testing program during the past year. Next year there will be an additional man working on the same project.

The project consists essentially in consecutive mental, physical, and educational measurements of the same children twice each year over a period of three years. During the past year the National Intelligence Tests, Form A and B, and the Thorndike Test of Word Knowledge have been given to the children in the chosen community who are in grades III to VIII. Moreover, measures of height and weight have been obtained as well as scores in Thorndike-McCall's Reading Test and Woody McCall's Mixed Fundamentals of Arithmetic. In grade II the Dearborn Group Test of Intelligence and the Pintner Cunningham Primary test have been given while in grade I the latter test has been given. Great care has been exercised in getting the exact ages of children. Thus in our first year we have several records in the case of each child and have tested about 1,100 children. The general problem is to determine the environmental effect of a cotton mill on the growth of children.

A Statement similar to the above was presented to the Southern Society for Philosophy and Psychology at their annual meeting in Chapel Hill.

PAUL W. TERRY has conducted the following investigations during the year 1924-1925:

Providing Adequate Housing Accommodations for the Junior High School. *School Review,* January, 1924.

A study was made of the floor plans of a large number of modern junior high school buildings with a view to learning what types of floor space were most frequently provided. A list of the most essential types was given. It was found that buildings that were originally planned for junior high schools had more modern spaces than those that were remodeled. Old high school buildings contained more of the desired types of floor space than old elementary buildings. The significance of the problem lies in the fact that the educational program of the school depends in great measure on the facilities of the building.

Legislation on the Junior High School. *U. S. Bureau of Education Bulletin No. 29,* 1924, Chapters I-V, Pages 1-42.

Chapter I consists of a brief description of legislation concerning the traditional high school. In Chapter II a description and analytical discussion is given of legislation on the junior high school under the six following heads: procedure and conditions of establishment, additional funds for general purposes, wider distribution of privileges, extension of facilities, standardization and classification and provisions for administration of standards. Chapter III is devoted to the conditions under which junior high schools may be organized and the status of the ninth grade in states which have no legislation relating explicitly to the new school. In Chapter IV an account is presented of the laws which now prevent or hinder the development and laws which are needed to facilitate development. The final chapter is concerned with a discussion of the problem of stimulating development by means of legislation and three attitudes towards legislation for this purpose were found to be held by school men: no additional legislation is needed; legislation is needed for the removal of obstacles only; and legislation in broad general terms only is needed. An appendix contains a compendium of all laws in all states relating directly to the new school. Data for the study were obtained from question blanks and from analytical studies of existing laws.

PROFESSOR TERRY has the following studies in progress:

Supervision of Extra-curricular Activities in the Junior High School.

The practices of the better type of urban junior high schools in the organization and supervision of extra-curricular activities. Description is given of the number of organizations per school, the types of organizations found, those found more and less frequently in schools of various sizes. An analysis is made of the programs of activities in individual schools. Account is taken of the rules which relate to limitation and encouragement of pupil-participation, records of participation and time, frequency and place of meeting. Special attention is given to the significance of the home room and the work of the teacher adviser. (Almost completed and will appear in bulletin or monograph form.)

The Honor Society and its Functions in the High School.

The aims which have been used in theory and practice to guide the development of honor societies are studied and the extent to which they have been exercised in the chapters of the National Honor Society of Secondary Schools.

The Teacher's Load and the Supervision of Extra-Curricular Activities.

An investigation of the amount and kind of labor and responsibility which teachers incur in addition to the work of the regular school day in sponsoring pupil-organizations of various types.

Features of the Organization of Extra-Curricular Activities in the Traditional High School.

An investigation of the costs, number of teachers involved in supervision, and of the plans which have been adopted by a large number of high school principals to control pupil-organizations and to make them realize worthy educational objectives.

Professional Aspects of the High School Principalship.

A detailed comparison of the principalship with several of the older professions in respect to those qualities which distinguish a vocation as a profession.

PAUL W. TERRY and T. W. VALENTINE. Retardation in Short-Term Schools. *The North Carolina Teacher,* Vol. I, No. 6, February, 1925, pages 170-172.

A comparison by grades of the ages of pupils in the white schools of Henderson County with special reference to differences in the amount of retardation in schools of different lengths of school term. On this basis the schools were divided into four groups: Group A, those having a nine months' term; Group B, those that had had eight months' terms for several years; Group C, terms lengthened in recent years from six to seven or eight months; and Group D, terms not longer than six months. The age-grade data show that the average number of years of retardation increases steadily from Group A to Group D. This condition obtains in nearly every grade taken separately. It is a convincing indictment of the inefficiency of the short-term school.

Abstracts of additional theses presented to the Department of Education for the Master's degree in June, 1925, follow.

NITA ANDREWS. A Study of the Public Schools of Orange County.

The purpose of this study was to trace the development of the public school system in Orange County from its beginning through the year 1924.

Among the chief sources of information were the reports of the State Superintendent of Instruction; Coon's *Documentary History of Public Educa-*

tion; Knight's *Public Education in the South* and Knight's *Public Education in North Carolina; Public Laws of North Carolina;* the *Minutes* of the County Board of Education from 1885 to 1923; and Noble's *The Teaching of County Geography.*

Educational conditions in Orange County up to 1840 were unsurpassed in any county of the state. At that time many of the academies of the county had won wide fame. But the years 1839-1860 witnessed the beginnings of the public school and the decline of the academy. During this period education itself in Orange County declined mainly on account of inefficient supervision, the scarcity and lack of textbooks, insufficient funds, and poorly trained teachers. In 1852 the office of state superintendent of public instruction was created and Calvin H. Wiley was elected to head the school system of the state; under his supervision the entire system of the state became more uniform in the matter of textbooks and of teaching-force.

In the year 1860 the Civil War practically destroyed the entire school system; so severe was the blow that it did not recover until 1900. The people were forced to turn their attention to the immediate problem of rebuilding their homes and as a result the schools were practically closed, until 1885 when the county elected its first superintendent of public schools after the war. With the exception of this step little progress was made until 1900.

The Aycock Revival in Education in North Carolina found Orange County responding creditably. Much improvement appeared in the educational work of the county between 1902 and 1912. About 1920 the county board adopted a plan of reorganization including consolidation which has been followed with some consistency. The plan called for nine or ten central schools and the transportation of children to them. The last of these schools will be completed in 1925.

The chief weakness of the school work of the county is the lack of good teachers.

W. B. COVINGTON. The History of Public School Finances in North Carolina.

Prior to 1800 very few people thought of education as a function of government; even after the adoption of a state system of schools in 1839, it was generally felt that common schools were for "common people"; and it was only the indomitable spirit of Wiley that overcame this public prejudice and united the educational forces of the state into a creditable state system of schools during the late fifties and kept alive during the Civil War the faith which had been built up.

The second period, 1868-1900, although initiated with great promise through constitutional provisions for a system of schools supported by state and local taxation, was filled with great difficulties. The fear of negro control and mixed schools, inconsistencies in the constitution bearing upon the subject of education, and discouraging economic conditions made it impossible to raise funds sufficient to establish satisfactory schools.

The present state system of public schools with an annual expenditure of more than $30,000,000 is an evidence of the rapid progress made by a band

of young North Carolinians who took over the government with a determination to lift the state to an industrial and intellectual position of which its citizenship might be proud.

The conclusions reached in this study show that educational development in North Carolina has been the result of social, political, and economic conditions; that progress has been as rapid as these conditions would permit; that the people of the state have gradually accepted the principle of taxation for public schools as public opinion has grown in this direction; that the policy of state aid as a stimulant to local support has aided in the development of this principle; that the trend has been toward state control of education; that the county unit of organization under a state system of administration is the wisest policy for the state; and that indirect means of taxation must be used to supplement the revenues from direct taxation to insure equal educational opportunity to all with an equitable distribution of the burden.

A. R. REEP. The Educational Influence of the Methodists in North Carolina.

The purpose of this study was to show something of the influence of the Methodists—church, school, teacher, layman—upon education in North Carolina from the beginning of the Church until the present time. In order to do this it has been necessary to find out something of the beginnings of Methodism in North Carolina. The early circuit riders were the first to spread the gospel of an educated constituency. Though ill-prepared to preach or teach they found a people ready and anxious to learn something of the world outside their little sphere.

Out of that vast multiude of early school men which Methodism has given to the state three, Brantley York, Braxton Craven, and Robert L. Abernethy, were the most outstanding examples of perseverance in school work. Their work laid the foundations of more than a score of schools, among which are Duke University and Rutherford College.

A search of the records revealed the fact that more than fifty schools have been affiliated with or belonged directly to the Methodist Episcopal Church, South, in North Carolina. These schools served the state when the state was attempting to find itself, when the state school was so ineffective. With very little support they served well their day. A great many of them were not able to live through adversities which came to them. Nine of the fifty-odd schools mentioned before are in existence today. They have survived the vicissitudes of the past and are today ready to serve, even better than they have in the past.

Methodism has had a very salutary influence upon education in the State of North Carolina, and as a result of this influence the state schools have been helped in the attainment of their present status.

HARVEY CALDWELL RENEGAR. The Problems, Policies and Achievements of Calvin Henderson Wiley.

The purpose of this study was to find the educational problems, policies and achievements of Calvin Henderson Wiley, North Carolina's first state superintendent of schools.

The sources of information used in the study were laws, reports of the state superintendent of public instruction from 1854-1866, the *North Carolina Journal of Education* from 1856-1863, and Coon's *Public Education in North Carolina, A Documentary History,* 1790-1840. In addition to these sources many other secondary accounts of educational effort in North Carolina prior to 1860 were used.

The study shows that Wiley was the foremost educational leader during the period before the Civil War. He led the educational forces of North Carolina against tradition, hostility to taxation for schools, and many other obstacles to public educational progress, and at a time when public schools were not considered a proper function of government. The policies which he adopted and followed for educational improvement in North Carolina were sound for that time and have many lessons for the school administrator today. Publicity Wiley used effectively, to arouse the people of the state to a need of better schools and to lead governing authority to see its obligation to provide better means of education. Wiley's achievements were notable; largely through his leadership North Carolina was able to set up during the last decade of the ante-bellum period a creditable system of public school work. His success in North Carolina attracted attention in other states and he was in demand as writer, speaker, and defender of the public school idea before legislatures and educational associations, local and national in character. His reports to the legislatures of North Carolina are among the valuable documents of public educational history in the South, as indeed of the entire country. His educational journal, the state teachers' association, which he promoted, and other services in the cause of better schools gave Wiley rank as one of the most distinguished public educational advocates of the United States during the second quarter of the 19th century.

CARL HOLMES WEATHERLY. Public Education in South Carolina Prior to 1860.

The purpose of this study was to investigate in all its phases public education conditions in South Carolina prior to the Civil War.

All available primary and secondary materials have been examined. Especial attention has been given to the *Report on the School System of South Carolina* (1839), which contains many observations and suggestions from the most able men of the time. Much valuable information was secured from B. R. Carroll's collection of colonial pamphlets and documents, from Dawson's *Contributions to American Educational History* (United States Bureau of Education), and from Knight's *Public Education in the South.*

The study shows that during colonial times the educational system in South Carolina was copied almost directly from England—modified to fit conditions.

Because of local conditions a system of public schools was naturally slow to develop.

The element of charity was the chief defect of the early free school system in South Carolina. The entire system was for the benefit of the poor. The upper section of the Colony was settled chiefly by Scotch-Irish and Germans, who brought their own systems of education with them, mainly private academies which were very efficient.

The public schools of South Carolina did not reach a state of proficiency prior to the Civil War, because of geographical, economic, and social conditions. Differences between the upper and lower sections of the state, the small population, together with the economic and social conditions, combined to prevent the commonwealth from establishing an efficient system of public schools. Moreover, the greater number of people preferred to send their children to private schools and to academies. This latter type of schools was the most highly respected means of education in South Carolina.

The city of Charleston had developed a splendid system of schools before 1860, but it was overthrown by the Civil War.

The fact that South Carolina produced so many distinguished men and played such an important role in the affairs of our country down to the close of the Civil War is pretty good evidence that her people, upon the whole, were as intelligent and as well educated as those of any other section of the Union.

CURTIS L. WEATHERS. Public Teacher-Training Agencies of North Carolina.

The purpose of this study is two-fold: to trace the development of the idea of teacher-training at public expense in North Carolina, and to indicate briefly the present status of the various agencies maintained for that purpose by the state today.

With the exception of the aid given Craven's Normal College, there was no conscious effort to train teachers at public expense in North Carolina before 1860. The period between 1860 and 1900 is characterized by an enlivened interest on the part of the people, which manifests itself in the rapid rise and spread of local institutes at the close of the Civil War; in the later growth of local and summer normals, followed by county institutes; and in the final appearance of a permanent state normal towards the close of the nineteenth century. Since 1900 additional normal schools have been established; and furthermore, there have appeared a number of other training agencies—county summer schools, high school training departments, correspondence courses and extension classes.

The state today maintains for training white teachers: two departments of education; one four-year teachers' college; two two-year normal schools; six approved summer schools, three of which offer special work for principals and superintendents, and one of which offers courses for teachers of vocational subjects; a varying number of county summer schools; training departments in eleven standard four-year high schools; correspondence courses in one institution; and extension teaching in three institutions. For negro teachers

the state has: four normals; one department for teachers of agriculture; five approved summer schools; extension classes in four schools; training departments in ten private schools; and a few county training schools. For Indian teachers the state supports one normal and a county summer school.

The state should provide for: (a) the immediate establishment of an additional two-year normal for white teachers, to be followed by three others; (b) the enlargement of Appalachian Training School and Cullowhee Normal and Industrial School, with a view to raising them ultimately to the status of four-year normals; (c) the enlargement of the capacity of East Carolina Teachers' College; (d) the organization of high school training departments on the basis of graduation from a standard four-year high school; (e) adequate provision for observation and practice teaching at the University; (f) a more uniform grouping of teachers of like training and experience in courses given in approved summer schools; (g) additional extension class teaching; and (h) the early discontinuance of county summer schools.

DEPARTMENT OF ENGLISH

EDWIN GREENLAW has continued work on the variorum edition of Spenser, of which he is chief editor. Books I and II of the *Faerie Queene* are partially ready for the press. In connection with the meeting of the Association of American Universities, at Minneapolis, October 30-November 1, 1924, he presented a paper on "Recent Movements for Coöperative Research in the Humanities" (published in the *Journal of Proceedings* of the Association). At the meeting of the National Council of Teachers of English, held in St. Louis, November 26-28, 1924, he read a paper on some aspects of the scientific and literary imagination, based in part on a passage in Wordsworth's *Prelude,* and discussing Wordsworth's theory of the imagination. At a meeting of the Advisory Board of the Guggenheim Foundation held in New York in April, 1925, he read a paper on fostering research through special grants and short leaves of absence for the benefit of men working in colleges remote from large libraries and laboratories. His report as Dean of the Graduate School further defined a conception of the relation of the university to research and of the difference between a college and a university judged by this definition. This completes a series of four reports on "The University and Research."

The following additional investigations have been completed by Mr. Greenlaw:

The Return to the Classics. *Studies in Philology,* XXI, 649-661 (October, 1924).

A survey of recent literature interpreting the classical influence in medieval and modern literature and thought. This is made the basis for a statement of a theory of translation applicable to the study not only of the classics or of modern foreign languages, but to literature in the vernacular as representative of past times.

The New Science and English Literature in the Seventeenth Century. Lecture on the Tudor-Stuart Foundation at the Johns Hopkins University, January 16, 1925. Published in *The Johns Hopkins Alumni Magazine,* XIII, 331-359.

Current histories of English literature give no adequate view of the intellectual history of the seventeenth century. That century saw the beginnings of modern research in history, linguistics, and science; it first phrased and put in practice the idea of progress that has transformed the modern world; in the development of philosophical and political theory it was one of the greatest of centuries. Yet literary manuals discuss the closed couplet, the Cowleyan Ode, and the decadence of the drama, to the exclusion of any consideration of the relation of literature to life. The intellectual history of the century is noteworthy for concreteness, for the overthrow of authority, and for the substitution of a theory of progress for the older concept of a Golden Age followed by decadence in Nature and Man. Illustrations of these principles are given, and the effect on English literature of the period is cited. Following this preliminary exposition, evidence of the direct influence of the new scientific spirit of the century on literature is given, not merely through allusions, many of which prove nothing, but in a deeper sense. Finally, the theory of the epic as a *speculum* or summary of all knowledge is discussed with special reference to Spenser and Milton, with the relations between the new science and this epic theory and practice.

Spenser and the Idea of Progress. A paper read before the Philological Club. For abstract, see page 92.

NORMAN FOERSTER read before the Philological Club in November, 1924, a paper on "Classical and Romantic Elements in Emerson's Conception of Art." In the April, 1925, number of *Publications of the Modern Language Association* appeared a descriptive bibliography of contributions to scholarship in the field of American literature for the year 1924. In this journal will appear an article on the idea of the organic in Emerson's conception of art. At present, Mr. Foerster is making a study of the early writings of Whitman, and is working toward a book on literary criticism in America. He is also editing the second series of American Studies, *Studies in Philology,* which

will include a report by a committee of the Modern Language Association on doctoral dissertations in American literature and on Americana in university libraries.

T. S. GRAVES* published the following articles:

Women on the Pre-Restoration Stage. *Studies in Philology,* XXII, 184-197.

This article presents evidence to show that while professional actresses were never regularly employed in England prior to the Restoration, women actors were not unknown or even novel in Elizabethan England. Many instances proving this fact come from records relating to what would now be regarded as vaudeville acts rather than the regular drama; women also appeared in masques and court entertainments; and there are records of visits by foreign companies of entertainers which included women. Thomas Jordan's "Prologue to Introduce the first Woman who came to Act on the Stage in the Tragedy, call'd The Moor of Venice" does not indicate that this person was the first actress to appear in England, but that she was the first female to appear in the role of Desdemona.

Recent Literature of the English Renaissance. *Studies in Philology,* XXII, 272-346.

A record of the more important books, articles, and reviews which appeared in the year ending January 1, 1925, with reviews or brief comment on many titles.

The Adventures of Hamlet's Ghost. *Philological Quarterly,* IV, 139-150.

After a preliminary statement of the "unusual" qualities of the Ghost, the history of the presentation of the part is traced from Shakespearean times to the present.

W. F. THRALL published during the year:

The Historical Setting of the Legend of Snedgus and Mac Riagla. *Studies in Philology,* July, 1925.

The existing versions of *Imram Snedghusa ocus Mic Riagla* are analyzed and compared, and evidence from early Irish annalistic, hagiological, and sea-voyage literature is cited to show that the original time-setting of the tale was mid-seventh century rather than late eighth century, as urged by Professor Thurneysen. The slight anachronism which even this interpretation does not obviate is chargeable to the original author, not to a reviser, and is explained by the author's conception of his background broadly as the heroic period of Irish ecclesiastical and secular history embraced by the late sixth and early seventh centuries rather than thinking of it in terms of centuries.

*Died March 6, 1925.

The King Domnall referred to is Domnall mac Aed mac Ainmire rather than Domnall mac Murchado. The participation of Colum cille of Iona (sixth century) in a seventh century story is accounted for mainly by the character of the legendary materials with which the author was dealing, in which similar confusion at times appears and in which Colum cille figures as the patron saint of the particular royal family involved in the events of the story.

A. C. HOWELL has published during the year:

Sir Thomas Browne and Seventeenth Century Scientific Thought. *Studies in Philology,* Vol. XXII, No. 1, January, 1925.

A discussion of Browne's position on the Baconian and Cartesian methods in scientific study, with attention to his work as a popularizer of science.

A Note on Sir Thomas Browne's Knowledge of Languages. *Studies in Philology,* Vol. XXII, No. 3, July, 1925.

This paper corrects Dr. Johnson's misquotation of James Howell and shows that Sir Thomas Browne's knowledge of languages was extensive and thorough.

A. C. HOWELL is at present investigating Browne's debt to Roman science and has in preparation a study of his use of Seneca's *Physical Questions.*

The following theses for the degree of Master of Arts were approved by the Department in 1925:

SARAH DUNCAN. Fame in the English Renaissance.

This essay is a consideration of the desire for fame in the English Renaissance as reflected in some of the representative literature of the time, with an introductory survey of the attitude toward fame in ancient and medieval periods.

The first chapter discusses briefly the two views concerning personal distinction held by the people of classical antiquity, the "Pro Archia" of Cicero being taken as an example of the predominating one, which is the thirst for glory, and the *Meditations* of Marcus Aurelius as illustrating Stoic condemnation. Boethius' *Consolation of Philosophy,* and the poetry of Geoffrey Chaucer present the "other worldliness" of medieval Christian theology, while the works of Dante, though colored with the thought of the time in the *Purgatorio* and *Paradiso,* anticipate certain aspects of Renaissance thought.

In the second chapter this passion for individual recognition, which is a keynote of Renaissance character, is considered in works of Marlowe, Shakespeare, Bacon, and Milton, the escape from oblivion gained through military achievement, through wealth, knowledge, high place, virtuous acts, and through children of the body and the mind.

The third and final chapter deals with the varied treatment of fame in the works of Edmund Spenser. The Stoic influence is to be found in the pastoral

sections, but the emphasis is largely placed on the desirability of fame, and especially on the immortality to be attained through verse and deeds of arms.

PHILIP LOVIN ELLIOTT. Plutarch's Idea of Poetry and Fine Art as Related to Renaissance Criticism.

Plutarch had a great influence upon the thought of the English Renaissance. In this essay an attempt has been made to single out some of the parallels between the mind of Plutarch and the age of Elizabeth. In the introduction a brief survey is made of the Greek age of the first century in order that we might better understand the man who most thoroughly interpreted it.

The first chapter seeks to establish the fact that Plutarch was known and loved in the Renaissance. A brief study of the editions and translations is made, covering the period 1530-1600, and comparisons drawn with other classic authors. Further evidence of his popularity is shown by the allusions to and quotations from his work taken from a representative group of such writers as Lyly, Bacon, Spenser, Jonson, Puttenham, Sidney, Harrington, Taylor, Montaigne, and others.

The second part of the first chapter seeks to answer the question: Why was Plutarch popular in the Renaissance? It is shown: first, that Plutarch was a veritable storehouse of encyclopedic classical learning; second, he had a universality of interests Elizabethan in scope; third, he combined the active and contemplative life; fourth, he had a catholicity of religious belief; fifth, his moral earnestness was intense; and sixth, he had an intense love of allegory. All these phases of his character anticipate the Renaissance and greatly appeal to it.

In the second chapter the attempt is made to link Plutarch with the critical thought of the Renaissance. After a brief introductory statement the theory of Plutarch is studied along with those of Plato and Aristotle. Plato's theory of art is obtained through a study of the *Republic,* "Symposium", "Ion", "Mene", "Phaedo", and "Phaedrus". Aristotle's theory is studied through the *Poetics* and such help as Butcher and Cooper. In each case the theory of imitation and end of art is stressed. Analogues, parallels, and divergences of the theories of Plato, Aristotle, and Plutarch are pointed out. The last part of the chapter is taken up with Sidney and the *Defense,* showing his relationship to each of the other three, and attempting to show that Plutarch served as a medium for much that Sidney got from Plato and Aristotle.

C. F. GADDY. James Russell Lowell's Knowledge and Use of Classical Mythology.

The purpose of the study was to determine the extent of Lowell's knowledge of classical mythology and the use he made of that knowledge in his writings.

The study was divided into two sections: first, the environment which shaped Lowell's early years, and second, the use he made of mythology in his writings. The first study served as a background, and the second gave more accurate information. Both methods were necessary, since references are not always a fair measure of a writer's knowledge of a subject. A careful

study was made of all Lowell's references to mythology to determine both their extent and their manner.

Lowell was born at a time when classical learning was stressed by all educators and reared in an environment that was decidedly classical. From his early writings it appears that at an early age he began to study and to like the great writers of classical literature. In his early poetry he made constant use and in his later poetry occasional use of mythology. To him it was a very appropriate means for expression. He often altered the story for the purpose of giving expression to his thoughts. He used myths, usually, for presenting some moral, which he either expressed or implied.

ANNIE OLIVIA HARMON. Hawthorne's Reading.

The purpose of this thesis is two-fold: first, to study Hawthorne's reading biographically, that is, to trace his reading from his earliest years to the publication of his masterpiece, *The Scarlet Letter;* and, second, to study the fields in which he read and to determine the relative prominence of each.

It was found, in Part One of this thesis, that Hawthorne possessed from early childhood a passion for literature; that he never outgrew *The Pilgrim's Progress* and *The Faerie Queene* and that during every period of his literary career their influence is plainly apparent; that Spenser, Shakespeare, Sidney, Milton, Johnson, and Scott formed practically an equal amout of his reading, with Spenser, Bunyan and Scott pervading in influence; that he was a student and a compiler of New England history, extending past the Revolution; and that "local history"—the tradition of the environment in which he lived—embracing the era immediately preceding, claimed the greater part of his reading from the time of his graduation from Bowdoin College until the appearance of his most remarkable work. The conclusion is that the majority of Hawthorne's extensive reading was done before the composition of his masterpiece and that it has hardly been realized hitherto what an omnivorous and careful reader Hawthorne was.

Part Two reveals Hawthorne's reading in the different fields of literature. Here we have learned that he had a group of acquaintances in virtually every age. Indeed, we might go a step farther and say that he was intimately acquainted with the greater number of the major authors of American and English literature. Added to these are an excellent knowledge of Latin, a fair knowledge of Greek (including a proficient knowledge of Greek mythology), French and Spanish, and a "plodding" knowledge of German. However, these languages, except the Greek mythology, were mostly neglected after his quitting college and hence they benefited him little in his writings. But probably this loss was made up by reading in other fields, for not only the best and the most elegant literature piqued Hawthorne's curiosity, but the most trite claimed his attention as well. Nothing in the way of reading matter escaped his notice. This is evident in that he read such relatively uninteresting materials as the Restoration drama and the forerunners of the modern novel.

In truth, wide gaps occur in Hawthorne's reading especially in Greek and German literature; but notwithstanding this, these are fewer and narrower, perhaps, than in the reading of most men of letters.

RAY LORENZO HEFFNER. Spenser and the British Sea-Power.

This thesis treats Spenser's interest in the making of a "New Imperial Britain" from the special angle of sea-power as a principle in the progressive policy.

It is pointed out that Spenser's interest in contemporary politics was constant throughout his active life, and that his views were consistently those of a "forward" school. A cardinal principle in the policy of this school was the curbing of the power of Spain through the establishment of English colonies in the New World to be used as a base for the attack on Philip, and through the destruction of the source of the Spaniard's wealth—the West Indies. The voyages of the Elizabethan sea-dogs—the chief ones being those of Drake, Gilbert, and Raleigh—were in accordance with this policy. These voyages were not only the germ of the British Empire, but also of the British navy that was to win and to hold this Empire.

Spenser's interest in Raleigh's voyages is summarized under the following heads: (1) In *Colin Clouts Come Home Againe*, Spenser gives the first recognition of Raleigh's part in the naval policy. (2) In the same poem Spenser and Raleigh seem to recognize the significance of the voyages of the Elizabethan sea-dogs, and that through these voyages Elizabeth had acquired dominion over the seas. (3) Spenser shows his interest in the "voyages" in the first three books of the *Faerie Queene*. (4) In the second three books, Spenser champions Raleigh's imperial schemes, both by his inclusion of Virginia in the dedication to Elizabeth, and in his defense of Raleigh's plan to seize and colonize Guiana.

Earlier conjectures that Marinell is Lord Howard are rejected. The chief characteristics of Marinell are: (1) his aggressiveness, (2) and his possession of the "spoyles" of all the world. Lord Howard was consistently a member of the "peace party," and up to 1590, by his own admission, had not captured a single Spanish prize. The suggestions that by Marinell Spenser meant Raleigh, Seymour, or a purely poetic figure are of doubtful value.

This thesis attempts to show that Spenser had Sir Francis Drake in mind when he wrote the description of Marinell. Drake fits in every point of the description. He was the most famous seaman of his time, and was the most feared man in the world. His name was synonymous with riches and "spoyles." Spenser was interested in the voyages of Drake not only through their political significance, but also through a large number of mutual friends who were interested in these voyages. Spenser mentions Drake's voyage of circumnavigation in the fifth book of his *Faerie Queene*.

JOHN CALVIN MCGALLIARD. Classical and Romantic Elements in Walter Savage Landor.

Generally regarded as a classicist who lived in a romantic age, Landor really combines in a remarkable way qualities characteristic of both schools. In this thesis an attempt is made to classify the various aspects of Landor under the three heads of genuine classicism, pseudo-classicism, and romanticism.

His earliest published work (*Poems*, 1795) is entirely in the spirit of the eighteenth century. Heroic couplets and the stock poetic vocabulary, diction, and allusions, mark it as an imitation of the style of Pope. The epic poem *Gebir* (1798) marks Landor's escape from the influence of this school. *Gebir,* written in blank verse, shows the direct influence of Milton and Vergil. Its obscurity is due in part to the author's attempt to imitate the brevity and compactness of Pindar.

Landor's classicism is shown to have been based on a solid foundation of literary and historical scholarship. To this sound knowledge was added a natural affinity with the Greek outlook on life and an enthusiasm for the ancient civilizations as they really were. In this respect Landor's attitude is to be distinguished both from the formal, artificial classicism of the eighteenth century and from the idealistic Hellenism of the later period. In this connection should be mentioned Landor's use of Latin as a frequent medium of original literary expression.

Landor's ideals of poetry, set forth in detached passages scattered throughout his works, are classical. He insisted on concrete, substantial themes, and clear, objective treatment. The poet should be master of the passions he expresses, not the reverse. The best style is that which is compact and concise, but graceful and polished as well. These criteria Landor applies with fair consistency, though unsystematically, in his rather extensive literary criticism. His attitude is impressionistic, that is, subjective, and to this extent romantic.

Landor's mature literary works are classical in manner. Regardless of age or subject, they have predominantly the qualities of concreteness, objective treatment, economy of effort, perfection of form, and restraint in expression. His prose style resembles in some respects the current eighteenth century type, in others, the best Latin prose. His *Helenics* are essentially Greek idyls written in English. His epigrams follow classical rather than eighteenth century models.

Landor"s romanticism of character—his excessive independence, self-assertion, and violent prejudices—is reflected in his works and renders them so far romantic. His theoretical philosophy of life combines a Stoic endurance of evil with a temperate, Epicurean enjoyment of the good. In actual life, Landor's revolt against the commonplace was impractical and futile; in literature, it appears more successfully as an attempt to realize the classical ideals.

ALEXANDER CLEVELAND SESSUMS. Studies in Samuel Daniel.

Part one of these studies is concerned with a discussion of the *Civil Wars.* (1) The sources of the *Civil Wars* are shown to be the chronicle histories and passages from the chronicles and Daniel's work are compared to illustrate Daniel's dependence upon them. (2) The historical-epic differs from contemporary epic standards in that it employs neither supernaturalism nor allegory; the scenes and characters are English and the events described have actually taken place; the invention of the poet is restricted by the adherence to historical fact. (3) The *Civil Wars* is then discussed in its relation to the works of Warner and Drayton. The patriotic impulse is shown to be the point of greatest similarity between them.

Part two treats the ideas, expressed in Daniel's poetry, concerning love, honor, learning, and religion, with parallels to Davies and Greville.

The last section is a brief study of Daniel's use of figures in his poetry, such figures as he uses being indicative of the general tone of his work.

WESLEY HILL SHINE. The Influence of Keats on Rosetti.

It has been generally accepted without proper investigation that Rossetti's poetry was influenced by Keats's. This paper shows a part of this indebtedness.

In the Introduction are presented (1) the outstanding conclusions reached by Mr. A. C. Benson, who believes in Rossetti's indebtedness to Keats, and the opposing view of Professor James Routh; (2) Rossetti's interest in Keats's poetry as displayed in his own comment; and (3) a brief, suggestive treatment of the similarities in the tastes and temperaments of the two poets.

The investigation proper proves an influence of Keats's poetry on Rossetti's, inasmuch as it shows that in three important poems by Rossetti the themes are similar to themes used by Keats, the treatments in two of these three analogies being strikingly similar in detail; in five instances similar situations are depicted, two of which are exceptional; in thirteen instances there are similar descriptions, five of them being unusual; in nine instances similar tropes occur, all of them pointing to Keatsian influence with varying degrees of certainty, and four of them showing conclusive evidence of indebtedness.

GAYNELL CALLAWAY SPIVEY. Elizabethanisms in Swinburne's Tragedies.

The purpose of this paper is to show specifically in what way Swinburne's tragedies are Elizabethan. The Elizabethanisms in the dramas are divided into two classes: (1) General Elizabethanisms: those which have been generally adopted by English romantic dramatists since the time of Shakespeare; (2) Direct borrowings: those which Swinburne has taken directly from Elizabethan dramatists.

In the first class similarities in technique, character, methods of characterization, subject matter, style, and versification are pointed out. Under the second classification two of Swinburne's plays are shown to be re-workings of Elizabethan dramas. Swinburne's *Locrine* follows closely an old anonymous play of the same name, in characters, plot and certain scenes. Sir William D'Avenant *Albovine, King of the Lombards* is proved to be the source of Swinburne's play, *Rosamund, Queen of the Lombards.* The similarities in action, character, and language are brought out. In addition to these dramas particular characters and scenes in Swinburne's tragedies are shown to resemble scenes and characters in Elizabethan plays.

EMMA SMALL TRABUE. The English Fairs and Their Theatricals.

This study was undertaken in an effort to determine the part played by the English Fair as an educational and cultural agency in the lives of the English people. A brief history of the development of these fairs through the Middle Ages, the Renaissance, and from the Restoration until 1745—the year in which theatricals reached their height—was undertaken in order to

reveal their antiquity and to make clear their relation to the historical events and social conditions by which they were produced.

This investigation has shown that foreign influences were introduced by minstrels as early as the seventh or eighth century, and that centers of amusement, during the Middle Ages and the early years of the Renaissance, existed not in fixed localities but in the great shifting capitals of trade. The play, as soon as it left the church in the middle of the twelfth century, went immediately into the fair where it passed through various stages of development.

By comparing the records and dates of the various fairs with the records of dramatic companies, evidence has been found which indicates that the fairs during the time of Elizabeth were frequented not only by minstrels, jugglers, posturers, and animal trainers, but were frequently honored by acting of the Queen's men.

The fairs helped to keep the drama alive during the Protectorate. Evidence is here reviewed showing that during these dark days the fairs were by no means devoid of amusement. The lack of restraint in amusements following the return of Charles II was at once reflected in the fairs.

The dramatic elements in the fairs developed to such an extent that by the year 1699 many of the legitimate playhouses closed their doors during the great London fairs, and the best actors of the day were frequently engaged to entertain the holiday crowds. Managers of the most important urban theaters frequently discovered at the fairs some of their most promising and successful talent.

WILLIAM STANFORD WEBB. Studies in the Renaissance Fable with Special Reference to Spenser.

The purpose of this essay is to present certain typical examples of Renaissance fable usage, to consider in more detail the fable material employed by Edmund Spenser, and to examine his methods of handling this material. Such a study properly begins with a brief consideration of the medieval fable in England, its source, nature, form, and popularity. Its characteristics and usages are shown to have survived in the Renaissance. New humanistic and pastoral aspects, unknown to the Middle Ages, are pointed out. Then examples following the traditional medieval usage are exhibited from representative English writers of the Renaissance—John Heywood, Wyatt, Lyly, Greene, Nashe, Lodge, Shakspere, and Bacon. These examples include (1) mere fable proverbs or allusions; (2) literary fables of simple type, which are employed in a larger piece of literature as illustrative similes and each of which is accompanied by its "moral;'" (3) allegorized fables or beast tales. Next these same forms of fable material are shown to have been employed by Spenser. And special attention is devoted to his beast tales—*Mother Hubberds Tale,* with its allegorical warning against the Duke of Anjou's attempt to marry Elizabeth in 1579-80; *Virgils Gnat* and *Miuopotmos,* allegories probably referring to the reward Spenser received for his warning. Since these tales belong to the popular tradition in poetry, fable stuff is altogether appropriate to them; but the *Faerie Queene,* being of the courtly and learned tradition, contains, it seems, no fable material.

The concluding study is of the four allegorized fables of the *Shepheardes Calender,* in "February," "May," "July," and "September." An attempt is made to account for the appearance of the fable in a pastoral poem; perhaps through the substitution of a fable for the beast exemplum used by Barclay in his eclogues, or, as had already been suggested, through Spenser's following of Chaucer. Moreover, it is shown that Spenser's technique with each of these four fables is the same. When the entire eclogue is considered *literally,* the fable situation is seen to be this: (1) in each poem there is a dialogue between two shepherds in which contrasting views are presented; (2) one of the speakers, to illustrate and drive home his contention, tells a fable; (3) in each case he states the moral he wishes to stress. More important, however, is the distinctive effect Spenser achieves by throwing the fable well to the end; the heavy stress it thus receives makes the idea in the fable dominate the poem. But this careful preparation is not for literal but for the allegorical interpretation. And this dominating idea, carried by the serious allegory of the fable, has likewise to do with warning Protestant England against her foes.

The following doctoral dissertations were approved by the Department in 1925:

JAMES MILTON ARIAIL. Some Immediate English Influences upon Spenser's *Faerie Queene,* Books I-III.

The purpose of this study is to examine the literature of England near in time and influence to the *Faerie Queene* with a view to ascertaining the relation that this body of literature of his own people had to Spenser's production. The *Faerie Queene* is shown to be a great summation of medieval literature, fused with the wealth of Renaissance thought and ideals, thus forming a complex and inclusive structure. To point out the elements that may be claimed as English is the main task undertaken. The classical influences upon the poem have, for the most part, been passed over, and of foreign and Italian influences, only that of Ariosto has been subjected to examination and restatement. Wherever an element in the poem has passed through the eclectic method of fusing and blending and transforming by which Spencer brought his great achievement to a finished product, effort has been made to seek the English influence lying back of this, provided this element is English.

The first ten cantos of Book I are taken to be basically, stripped of the romance element and all adornment, a composite of the conflict type morality plot and stage 1 of the Coming of Death morality plot as it appears in *Everyman.* The influence of *Everyman* is shown to be strongest in the House of Holiness canto. As proof of this position these cantos of the poem are reduced to the form of a morality play and numerous analogues from morality plays which were undoubtedly a part of Spenser's literary heritage and which we are practically sure that he knew, are submitted. It is also submitted that Spenser most likely began his work under dramatic impulse. To this interpretation of the *Faerie Queene,* several well known interpretations of the poem are related in an effort to show the margin of probability that is claimed for the Morality play as an influence.

Canto 11, Book I—the three days' fight—lying outside of the mortality scheme proper, is studied as the fusion of the mystery play based upon the Harrowing of Hell, as the profoundly religious element; the St. George legend, coming from folk drama, and the non-Arthurian romances, *Bevis, Guy,* and *Huon.* These influences are held to be English and to have been of profound significance in the life and thought of Spenser's time.

Chapter Three is an effort to determine Spenser's treatment of the Arthurian romances, and the part that the romances contributed to the structure, growth and final expression of the vast and definite plan which he conceived. It is argued that: (1) *Malory's* summation of the Arthurian romances was for Spenser a great and moving heritage from the past of his own people; (2) that Spenser knew and regarded as English and used such romances as *King Arthur, Sir Degore,* the *Squire of Low Degree,* the Gawain cycle, *Sir Perceval de Galles, Sir Lambewell, Sir Orfeo,* the *Avowynge of Arthur* and others, and that in incidents and details he used these in the pageant which he intended his poem to present. Analogies between incidents in Malory and the romances and the *Faerie Queene* are pointed out and important and significant passages are thus found to be strongly English. The romances are not claimed so much as an influence as an illustration of the deliberate and serious manner in which the poet approached this body of literature. Rather the romance is taken as the setting, and contributed much in detail to the expression of his England as he saw it. It is held that he took this old material with much of its old significance and erected upon it a structure inclusive of old truth and beauty yet new in that it upholds an epic in accordance with the conception of his own day, and symbolizes an heroic past out of which the nation's greatness had come and upon which might be based a policy and prophecy of a greater England yet to be.

Chapter Four contains a study of the influence of Ariosto on Spenser based upon the "Imitations" collected by Professor Dodge. The purpose of this chapter is not to question the importance of the influence of Ariosto on the *Faerie Queene,* nor to controvert, in general, the article of Professor Dodge, but by a re-examination of these imitations, with both Ariosto and the romances in mind, to claim many of these passages for the English romances, thus taking them from Ariosto and thereby increasing the margin of the English influences as against that of the Italian. It is shown that both Spenser and Ariosto had the corpus of the romance at hand and that some "imitations" may be due to a common influence and that others in reality are more accurately due to romance influence than to Ariosto. This position is upheld by analogies and specific instances from Spenser, Ariosto and the romances. The conclusion is reached that the influence of Ariosto has been overstated and that of the romances overlooked.

In the final chapter, some effort is made to study the political significance of the poem. It is shown that Spenser was intensely anxious to become an active part in the great movements of his day, that he had his political alignment, his political theory and saw, perhaps with a poet's vision, deeply into that policy which in the future should mould a greater England. This political policy and faith he expressed in his poem when he found himself cut off from

that activity which he coveted. It is shown that there was a political tradition at hand when Spenser came; that the strong influence here and the intermediary of this tradition was John Skelton, and that his influence is chiefly noticeable in *Magnyfycence.* An examination of this influence is made and similarities in thought and conception are pointed out. Skelton, then, typically English, is taken to be an important element in shaping the political structure of the poem. Throughout the entire study evidence is submitted to show that these influences were close at hand, that they were English, and that Spenser's poem is far more indebted to the literature of his own land than has been conceded.

A. THEODORE JOHNSON. The Supernatural in Epic.

The purpose of this study is to determine what kinds of supernaturalism are distinctively epic and why the supernatural element is so prominent in epic. The dissertation is based upon a consideration of some of the greatest epics in literature from Homeric times to Milton, with special reference to English epic and its literary progenitors, and includes the following: the *Iliad* and *Odyssey,* the *Aeneid,* the *Divine Comedy, Orlando Furioso, Jerusalem Delivered, Beowulf,* the *Faerie Queene,* and *Paradise Lost.* The use of myth and legend purely for ornament, and the history and sources of myth, are excluded from consideration.

Epic supernaturalism is partly traditional, but it may not degenerate into mere conventional machinery; it must represent genuine belief, but not necessarily literal belief. The epic may introduce characters and scenes which cannot be represented on the stage, and may be longer than dramatic works; hence its scope is greater and more inclusive. The epic has the quality of universality, and this quality is secured through the use of the supernatural. The types of supernaturalism that are considered as distinctively epic, as contributing to epic universality, are (1) religion, (2) the theory of divine origins of heroes and rulers, and (3) cosmology.

The first chapter deals with the subject of religion, which is an universal element in human experience. Religion is considered under five heads: (1) primitive religion, (2) the use of classic myth by Christian poets, (3) contemporary religion, (4) religion and the epic hero, and (5) the gods as characters in epic. Elements from primitive and folk religion are numerous, because these elements have a place in the culture history of a race, and linger long in a nation's consciousness, especially among the rural population. The allegorizing treatment of classic myths from medieval times onward made their use by Christian poets not only possible, but a convenient method of conveying abstract ideas by means of familiar images and stories. Contemporary religion, most vital of all to epic supernaturalism, emphasizes the right relation between man and the Supreme Power controlling all things. The religion of epic is not narrow or controversial; it is the religion of the nation to which its author belongs. The success of the epic hero depends upon the favor and help of this Supreme Power. The use of the Deity as a character in Christian epic is very much restricted, but the theme of the conflict of good

and evil powers is present. The gods are prominent characters in classic epics, largely through their effect upon the mortal characters.

The second chapter is concerned with the theory of supernatural origins in the state. The spirit of nationalism and the need for regularly constituted authority are also elements which make for universality. Prior to the time of Milton, the king was the state; epics are courtly, undemocratic, in tone. Epics, therefore, with the exception of *Paradise Lost,* glorify a ruling family; they show divine interest in a nation as the perpetuator of a form of worship; they are the completest expression of a nation's genius.

The third chapter takes up the cosmology of the epic. Under this head are considered the nature of the universe, theories of creation, the plan of the World, and the place of the dead. The importance of this element is not that the epic includes everything; its purpose is not merely to teach a system of astronomy. The epic sets forth in its cosmology the place of man in the universe. The presentation of a scheme of the cosmos is a necessary element to epic scope; the action of epic includes all the known world and the world of spirit; the universe is its stage.

Distinctively epic supernaturalism, therefore, is that which has to do with religion, national feeling, and cosmology, three vital, universal, and imperishable themes.

WILLIAM DOUGALD MACMILLAN III. Planché's Extravaganzas.

The purpose of this study is to examine the extravaganzas of James Robinson Planché (1796-1880) with a view to determining their place in the history of the English drama and to appraising their work as artistic efforts. These extravaganzas were immensely popular during the fourth and fifth decades of the nineteenth century. In them, therefore, is found a reflection of the dramatic taste of the English people of that period.

In order to understand the nature of Planché's extravaganzas one must examine certain of their predecessors in the field of burlesque, particularly several types that flourished in the eighteenth century. These types—literary satire, pantomime, burlesque opera, and the "burletta"—are not clearly distinguished from each other; but from each the extravaganzas derived distinctive qualities. In the extravaganzas we find elements of satire and spectacle; and most of them are written in the ballad opera form, invented by Gay and popularized in *The Beggar's Opera.* The extravaganza, then, as written by Planché, is a sort of ballad opera with the addition of elaborate scenery.

The introductory chapter of this study is devoted to a discussion of the nature of popular burlesque forms on the English stage before the appearance of Planché's first classical extravaganza (1831). This phase of the subject is treated under three heads, as follows: 1. Literary satire—as in *The Rehearsal* (1671), Fielding's *Tom Thumb* (1730), Carey's *Chrononhotonthologos* (1734), Foote's (?) *The Tailors* (1767), Garrick's *A Peep Behind the Curtain* (1767), Sheridan's *The Critic* (1779), Canning's (?) *The Rovers* (1798), Rhodes's *Bombastes Furioso* (1810), and Planché's own *Amoroso, King of Little Britain* (1818). 2. Pantomime—its popularization as elaborate spectacle by John Rich and its continued success. 3. Ballad Opera and Burletta—

examples are *The Beggar's Opera* (1728), Carey's *The Dragon of Wantley* (1737), Kane O'Hara's *Midas* (1764), Colman's *The Portrait* (1770), O'Hara's *The Golden Pippin* (1773), Dibdin's *Poor Vulcan* (1778). The last part of this chapter contains a discussion of the early influences on Planché himself with the emphasis on the performances that he probably witnessed in person.

In the second chapter are found the results of an examination of the extravaganzas themselves with regard to subject matter, sources, and method and characteristics. From the point of view of subject matter the plays fall, practically exclusively, into three groups, one being composed of those plays whose plots are derived from stories found in classical mythology, another, which contains the larger number of plays, having as the source of the material nursery and fairy tales. The third group is composed of the eight *revues,* whose subjects are, of course, contemporary theatrical events. The few extravaganzas that do not fall into this classification are, for the purposes of this study, unimportant. The sources of the classical burlesques are the well-known myths. The greater number of the fairy pieces are based upon stories from the French fairy tales of Perrault and Mme. D'Aulnoy; but three fairy pieces find their plots in stories by Mme. le Prince de Beaumont, Mlle. de la Force, and the comtesse de Murat.

The method used by Planché in writing the extravaganzas is exceedingly simple. He dramatizes a short, well constructed story in a concise fashion, relying for success on the appeal of the story itself and of the interpolated songs. The characters that appear are, with few exceptions, not developed with any attempt at distinct portrayal. The dialogue is usually in iambic pentameter couplets. In all of the extravaganzas except three Planché used the method, already familiar in the ballad operas, of setting new words to well-known tunes. He had an aptitude for composing easy parody; and the songs frequently form the most pleasing bits in the extravaganzas. They contribute always to the action or the atmosphere of the piece, fit their tunes aptly, and are quite good as humor or nonsense in themselves. Examples are abundant, as each extravaganza contains many songs. Puns are comparatively infrequent, but the extravaganzas contain a large number of parodies of lines from Shakspere's plays. Other less pronounced evidences of literary satire are found in various extravaganzas, and in the *revues* is comment upon a large number of contemporary popular plays. "Topical allusions," also, furnish the point for many jokes, particularly in the *revues,* though Planché was not generally in favor of writing exclusively for a London audience of any particular year.

Many of Planché's extravaganzas were produced with considerable attention to elaborate, spectacular settings, and introduced on the London stage a period of intense competition among managers for honors of a spectacular rather than a dramatic sort. Planché objected to this unhappy result of his own efforts and tried to elevate the moral and intellectual tone of the stage of his day. His consciousness of a serious purpose prevented his sacrificing what he thought was his art to the whims of managers or the degraded taste of the public.

The third chapter contains some account of the influence of Planché's extravaganzas as it is seen in contemporary accounts of their work and popularity and in the plays of various authors who followed Planché's example. Contemporary accounts of Planché's plays and of the actors and other persons associated in their production show that the general impression made by these pieces upon audiences and critics alike was favorable. Shortly after the first success of Planché's early pieces a long series of burlesques in imitation of his extravaganzas began to appear. The work of William and Robert Brough, Francis Cowley Burnand, Francis Talfourd, and Henry James Byron may be regarded as typical of those produced by Planché's imitators. They are generally inferior to Planché's work and characterized on the whole by the silliness of the dialogue, the prevalence of puns, the looseness of the plot construction, and the absence of any definite artistic or moral purpose. The charm that made Planché's little plays had disappeared and extravaganza became merely a vehicle for elaborate scenery and the display of dancing girls. Planché's extravaganzas, nevertheless, prepare in some measure the way for the comic opera of Gilbert and Sullivan. They were, at any rate, among the most popular, and therefore momentarily among the most influential, of the lighter dramatic pieces of their day.

F. T. THOMPSON. Emerson's Debt to Coleridge, Carlyle, and Wordsworth.

On the twentieth of August, 1837, eleven days before the delivery of "The American Scholar" address, Emerson wrote in his *Journals,* "Carlyle and Wordsworth now act out of England on us—Coleridge also." My thesis is an effort to explain not only the influence which Emerson here acknowledges, but also to determine, in so far as his journal permits, the years in which he drew most upon these men for inspiration.

To make clear that there was a distinct period in which Emerson was predominantly influenced by Coleridge, Carlyle, and Wordsworth, I have in part attempted to show that Emerson's study divides itself naturally into three groups, and possibly four. The first is the period when Classicism, more particularly Platonism, claimed his interest. In these years we find that Emerson read widely in Plato, Homer, and the Greek drama. He related Plato with the Romans, Plotinus, and the Renaissance; hence he was vitally concerned with the work of Montaigne, Bacon, Spenser, Shakespeare, and Milton. He was also attracted to Pope. Emerson never entirely lost this early enthusiasm for the Classics and allied literatures, but his greatest enthusiasm for them came in his youth.

The second period begins with the reading of *The Friend* and *Aids to Reflection* in 1829 and extends to the decline of the Transcendental movement in 1843-44. This is the period dealt with in my dissertation.

The third period extends from about 1845 to the publication of *The Conduct of Life* in 1860. This period is marked by a decided preference for Oriental philosophy and literature. Though Emerson read Zoroaster as early as 1820, and though he added many other Oriental books to his reading list during the years 1920-44, we find in the *Journals* no enthusiasm for Orientalism

comparable to his enthusiasm for Romanticism when he published *Nature* (1836) and delivered "The American Scholar" (1837) until the years 1845-47 inclusive. In these three years Emerson literally devoured the large quantity of Oriental literature and philosophy that was flooding the American press at that time. The result of this intense reading is found in such a lecture as "Fate," delivered in the early fifties.

If there be a fourth period, we may call it the period of science. Emerson was always interested in this subject, but it seems to me that science is far less implied in his Transcendentalism than it is in the *Society and Solitude* series of 1870. "Civilization," which is included in this series, reflects clearly the revolution in science that followed the publication of "The Origin of Species" in 1859.

In the period with which my dissertation deals, these various streams of influence may be seen and felt. So, too, may be seen the influence of Byron, Scott, Shelley, and Keats. But Emerson outgrew his youthful fondness for Byron and Scott. And in the years following the reading of *The Friend* neither Byron nor Scott appealed to Emerson. Shelley and Keats, so far as I can determine, never aroused any enthusiasm in Emerson.

To Coleridge, Carlyle, and Wordsworth we may attribute Emerson's conception and use of Romantic literature and philosophy. In *The Friend* Coleridge bridged the gap between Platonism and Transcendentalism. From this book, together with *Aids to Reflection,* Emerson got the distinction between the Understanding and the Reason, the distinction which forms a basic part of Transcendentalism. In *The Friend* Emerson also found warm praise of Wordsworth. This criticism, together with the criticism of Wordsworth in the *Biographia Literaria,* overcame Emerson's early hostility to all Wordsworth's poetry except the "Ode," and led to Emerson's acceptance of Wordsworth as the most original poet since Milton and the sanest spirit of the age. From the *Biographia Literaria* Emerson also got the distinction between the Imagination and the Fancy, as well as the kindred distinction between Genius and Talent. These distinctions possibly form as great a part in the development of Emerson's philosophy and literary expression as does the distinction between the Understanding and the Reason.

The influence of Carlyle begins with Emerson's reading *Wilhelm Meister* in 1830. But Carlyle's influence is more apparent in 1832 after Emerson gave up the ministry. At this time he read with enthusiasm such essays as "Corn-Law Rhymes," "The Life of Schiller," Jean Paul Friedrich Richter." The "Life of Schiller," published in 1824, was, however, more instrumental than anything else which Emerson read in turning his feet toward Europe and Carlyle. I hold that, so far as Carlyle influenced Emerson's Romanticism, we need to consider the influence that Emerson felt in 1832 rather than the influence that came from his visit to Carlyle in 1833, from reading *Sartor Resartus* in 1833-34, and from his correspondence with Carlyle. Had Carlyle's attention been given to German Transcendentalism during the years 1833-37, when he was working on *The French Revolution,* we might well emphasize what Emerson gained from Carlyle after his visit. But to all Emerson's invitations to lead the New England Transcendental movement, Carlyle turned a deaf ear. And he ignored Emerson's growing enthusiasm for German Transcendentalism.

Emerson turned to Coleridge's interpretation of Kant for his Transcendental philosophy. From Coleridge, too, he derived an exhaustive criticism of Wordsworth's theory and practise of poetry. Having recognized the worth of Wordsworth's poetry, Emerson went back to "Tintern Abbey," the "Ode," "The Ode to Duty," "The Excursion," "Yarrow Revisited," and other poems for inspiration in his study of nature. This intense study of Wordsworth's poetry was made in the very years when Emerson was mastering the distinction between the Understanding and the Reason and between the Imagination and the Fancy. Its result is seen primarily in the spirit of worship which characterizes all his impassioned nature passages, both in prose and verse, for a period of at least six years. It is seen in *Nature* where Emerson uses many of the leading ideas of Wordsworth, such as the healing power of nature and the joy to be found in nature. It is further seen in the adoption of the measure of the Pindaric Ode as the verse form for such poems as "Woodnotes" and "Monadnoc," as well as for many shorter ones.

The important dates in my analysis of Emerson's debt to Coleridge, Carlyle, and Wordsworth follow:

1826. Theory of poetry and criticism of the "Ode."
1829. First acquaintance with *The Friend* and *Aids to Reflection.*
1830. The reading of Carlyle's translation of *Wilhelm Meister.*
1831. Friendly criticism of Wordsworth and his poetry.
1832. Period of greatest influence from Carlyle.
1834-
1836. Mastery of the distinction between the Understanding and the Reason, between the Imagination and the Fancy, and between Genius and Talent.
Acceptance of Wordsworth as the greatest poet since Milton.
Intense study of nature.
Friendship with Carlyle.
Publication in America of *Sartor Resartus.*
Publication of *Nature.*
Organization of the Transcendental Club.
Emerson's preparation for leading the second meeting of the Club.
1837. "The American Scholar."
1838. The Divinity School Address.
1839. "Woodnotes, I."
1842. "The Transcendentalist."
1845-
1862. Oriental period.
1847. Second visit to Europe.

To the dissertation I have appended an index which gives easy access to the leading ideas involved in my study of Emerson's Romanticism.

DEPARTMENT OF GEOLOGY

COLLIER COBB has been engaged during the year in the physical analysis and microscopic examination of wheat soils from all parts of the earth, a part of the results obtained having been given to the

North Carolina Academy of Science in May under the title of "Loessal Soils and the World's Food Supply."

This study shows that the great stretches of grain-producing soils, whatever their origin, are composed of finely comminuted rock material in which the component mineral particles show but little chemical change. This is equally true of glacial, loessal, and desert soils.

PROFESSOR COBB has also studied an oil shale (a light gray clay-like substance—soft pelite) found by him in Ontario, Canada.

This substance burns like bitumen, and is made up of the leaves of *salix vaccinium,* and other species which still grow in the same general region and in northern Asia, and of the spores of a number of flowerless plants with essentially the same distribution, and extending well down into the main island of Japan (Honshiu).

W. F. PROUTY published during last year:

Geological Map and Report of Hardy County, West Virginia. West Virginia Geological Survey, 1925.

The following studies were completed during the past year by DR. PROUTY:

Geological Map and Report of the Ordovician Rocks of Pendleton County, West Virginia.

Reconnaissance Study of the Newark of the Deep River Basin with Detail Study of a Portion between Raleigh and Durham.

Structural Condition in the West Central Appalachians.

JOEL H. SWARTZ has continued his investigations of a new method for the correlation of the Chattanooga black shale. After experimenting with a great many different methods he has found three which give promise of offering a final solution of the Chattanooga shale problem. An outline of the general method involved has been presented in a paper before the North Carolina Academy of Science.

Brief Notice of a New Method of Stratigraphic Correlation. North Carolina Academy of Science, May 2, 1925.

The usual methods having failed to give definite results, a new method of stratigraphic correlation becomes necessary for the solution of the problem of the correlation of the Chattanooga black shale. Such a method is at present being perfected. It consists in bringing out, by appropriate means, the bedding planes in polished sections of the shale, and measuring their thicknesses. The thicknesses are then plotted as the ordinates of a curve whose abscissae are merely the numbers of the beds, after the manner of de Geer's glacial charts. By utilizing a number of different methods it is hoped not only to correlate

the shales, by matching plots from different localities, but also to determine whether or not the bedding is due to rhythmic precipitation of colloids, as held by many students of sediments.

An investigation of the radioactive content of North Carolina rocks has been begun. It is hoped to apply the results to a new method of determining the age of the earth. The gist of this new method was presented in a paper before the North Carolina Academy of Science.

Brief Notice of a New Radioactive Method for Determining the Age of the Earth. North Carolina Academy of Science, May 2, 1925.

The disadvantages of the present methods and the unproven assumptions upon which they rest were outlined. It was shown that the validity of the radioactive method, at present apparently our most accurate method, cannot be ascertained until the radioactive ages of a great many rocks of the same geological age but from many different localities are measured. This cannot be done with present methods since the latter can be applied only where the radioactive content is high, whereas most of the rocks to be used in such an investigation contain very little radioactive material. The following method is offered to obviate this difficulty.

The amounts of Radio-lead and Thorium-lead, Uranium and Thorium present in a rock at any given time, depends solely upon the original amounts of Uranium and Thorium and the "age of the rock," (i.e., of the Uranium and Thorium which it contains). The amounts of Uranium and Thorium now present can be easily measured. The amounts originally present bear a certain definite ratio to those now present, a ratio which is a function of the age of the rock and can be so expressed. The amounts of the two lead isotopes present are usually too small for detection by any ordinary method. The ratio of these two isotopes to each other can soon be obtained, it is hoped, by means of Aston's mass spectograph. If this ratio and the amounts of Uranium and Thorium now present in the rock are known, it was shown that the following equation could be obtained from the usual radioactive formulae:

$$\frac{\Delta N_U}{\Delta N_{Th}} \cdot \frac{N_{Th}}{N_U} = \frac{e^{\lambda_U t} - 1}{e^{\lambda_{Th} t} - 1}$$

in which N_u and N_{Th} are the numbers of atoms of Uranium and Thorium contained in the rock at the present time, ΔN_u and ΔN_{Th} the numbers of atoms of Uranium and Thorium which have broken down in time t, the age of the rock, (i.e., the amount of Radio-lead and Thorium lead now present in the rock), and λ_u and λ_{Th} are the disintegration constants of Uranium and Thorium. Since t is the only unknown quantity in the above equation, it may be solved for.

A Simple Proof of the Law that the Only Possible Periods of Crystal Symmetry are 1, 2, 3, 4, and 6. North Carolina Academy of Science, May 2, 1925.

It was shown that a plane parallel to the axis of rotation and at right

angles to one of the lateral axes of the crystal would, when passed thru any random raumgitter particle on the lateral axis, always intersect the adjacent lateral axis in a raumgitter particle also. Passing such a plane thru the first raumgitter particle on such an axis, it was shown that

$$\frac{1}{b} = \cos \alpha$$

where b is the intercept of the plane on the adjacent axis and α the angle between the two axes. Giving b all its possible integral values from 1 to ∞ it was shown that the only values for which α is an aliquot part of 360°, as required for symmetrical repetition, are 1, 2, and ∞, for which α is 360°, 180°, 120°, 90°, and 60°. The corresponding symmetry periods of 1, 2, 3, 4, and 6, are, therefore, the only possible periods of crystal symmetry.

During the months of July and August, 1924, Dr. Swartz assisted Dr. Prouty in the identification of an extensive collection of paleontological material from Hardy County, West Virginia.

DR. SWARTZ has conducted a series of experiments on the colloidal content of rocks in the hope of obtaining an accurate method of determining diastrophic changes. While the series is not yet complete, the results so far obtained indicate that the usual statement that the colloidal character of materials is not changed by grinding does not hold good for rocks.

G. R. MACCARTHY. Some Facts and Theories Concerning Laccoliths. (M. A. Thesis.) *Journal of Geology,* Vol. 33, No. 1, 1925, pp. 1-18. Abstract given in *Research in Progress* for 1924, pp. 55-56.

Iron Coloration in Rocks and Minerals. Read before the 1925 meeting of the North Carolina Academy of Science.

It would appear that, contrary to the accepted belief, the greens and blues of iron-bearing minerals are not due to the presence of ferrous iron as such, but to a hydrous ferro-ferric molecule; further, that ferrous silicates are colorless, ferric silicates light yellow to colorless, and anhydrous ferro-ferric silicates gray to black. The reds, yellows, and browns due to iron are ascribed to uncombined ferric oxides, and the rarer purples to a mixture of a blue and a red substance. These conclusions are borne out by both analytic and synthetic data, and further work is being done along this line.

DEPARTMENT OF HISTORY AND GOVERNMENT

J. G. DEROULHAC HAMILTON is still engaged in editing *The Papers of Randolph Shotwell,* part of which is now ready for the press.

WALLACE E. CALDWELL has published during the year:

An English edition of Capart, Jean: "Thebes, the Glory of a Great Past." Vromant, Brussels, 1925.

Studies in the Social and Economic History of Alexandria in the Ptolemaic Period. (In process.)

A. R. NEWSOME is at work on:

North Carolina during the War for Southern Independence.

The chief concern in this study is the social, economic and political, rather than military, history of the state from 1861 to 1865.

FRANCIS BUTLER SIMKINS has published during the year:

Guzmán Blanco: An Appreciation. *South Atlantic Quarterly*, October, 1924.

An attempt is made from information found in this country to give a critical estimate of the personality and work of one who ruled over Venezuela from 1870 until 1889.

One Hundred Years of Inter-American Relations. *Centennial Book of the Diario de Pernambuco* (Pernambuco, Brazil, 1925).

An attempt, based on general sources of information, is made to classify the relations between the United States and Latin America under the following headings: (a) Fraternal relations; (b) North American colonization in Latin-American areas; (c) North American hegemony; (d) North American imperialism.

The following essays will appear shortly:

The Tillman Movement in South Carolina. To be published by the Duke University Press.

An attempt, based on extensive information found in South Carolina, to explain the social and political changes which made inevitable the rise to political supremacy of the white democracy in place of the white aristocracy and the black democracy, followed by the story of the early life of Ben Tillman, the leader of this change, and a description of the actual achievements of Tillman and his coadjutors.

The Dispensary in South Carolina.

An attempt, based on extensive sources of information found in South Carolina, is made to describe that state's experiment in the public monopoly of the liquor traffic.

C. C. NORTON is engaged in a study of the Democratic Party in North Carolina from 1835 to 1860. The study involves the history of the

party with special reference to party leadership, organization, and politics. A critical analysis will be made in addition to the historical account of the activities and personnel of the party.

FRANCIS CHARLES ANSCOMBE has in preparation a work dealing with the Contribution of the Society of Friends to the Reconstruction of the South. In *Research in Progress* (1924) appeared a digest of the author's work on the Baltimore Association: the Quakers and Reconstruction in North Carolina. The writer is now expanding the subject, and is preparing a history which will include all the operations, both educational and philanthropic, of the Quakers in the South during this period. The new part will consist mainly of the work among the negroes, the Baltimore Association having limited its activities almost wholly to work among the whites. The writer has been extremely fortunate in securing access to the very detailed and complete archives of the Friends' Freedmen's Association of Philadelphia. He has also data on the contributions of all the Yearly Meetings of Friends both on this continent and in Europe. He expects to put the work in final form this summer.

The following Master's Theses were accepted by the Department in 1924-1925:

WALKER BARNETTE. The Beginnings of Party Organizations in North Carolina: A Documentary History of the Campaign of 1836.

This is a documentary history of the gubernatorial campaign of 1836 in North Carolina. The documents have been selected to show in so far as possible the party organizations for the first campaign in which the Governor was elected by the direct vote of the people, the methods of selecting candidates, the issues—State and National—which were involved, the interests of the people, the type of campaign, the editorial comment and influence, and the final results.

The Whig members of the Legislature of 1835 met in caucus December 22, 1835, and steps were taken at this meeting to carry on the campaign for both State and National offices. A Central Committee was appointed which was to have supervision over the subordinate Committees of Vigilance and Correspondence appointed in the various counties, and the county committees were to have power to fix their own membership. Further, the people were called to meet in the several counties of the State and declare their choice for President, Vice President, and Governor. The Democratic organization was similar to that of the Whigs. These efforts were the beginnings of the statewide organization of political parties in North Carolina.

The candidates were first mentioned by the newspapers, and then formally nominated by the county meetings. This somewhat crude system of nominat-

ing candidates finally grew in 1839 and 1840 into the party nominating conventions.

The gubernatorial campaign of 1836 was greatly overshadowed by the presidential campaign of that year. Practically all the Preambles and Resolutions adopted in the various counties were in regard to National issues. The fitness of the candidates for Governor was judged by their position on National issues or their support of the National candidates. Little mention was made of State issues.

WILLIAM PEW BRANDON. Van Buren and the Establishment of the Independent Treasury.

Almost immediately after his inauguration Van Buren was forced to take measures to allay the financial stress of the country caused by the panic of 1837. Out of this panic, and the restorative measures applied by the government, grew the Independent Treasury. This thesis is a study of the establishment of that system.

Chapter I deals, in brief form, with Jackson's Bank Policy, and the events of his second administration. Chapter II discusses Van Buren's choice of proposals to Congress and the reasons therefor. Chapter III deals with the treatment received by the Independent Treasury at the hands of Congress. Chapter IV consists of summaries. A summary of the provisions of the Independent Treasury Act as finally passed is included as an appendix.

It was found that Van Buren rejected both the National and State Bank systems. His reasons for that rejection seem to have been well founded. He gave all his influence to the Independent Treasury because of definite advantages offered by that system.

It was found that Calhoun was most influential in obtaining the final passage of the act. He supported it because of a belief that it was in accord with the principles of the Jeffersonian party of 1798 and 1799. This support marked the breaking of Calhoun's alliance with Clay and Webster, the alliance having lasted some three or four years.

It was found that Van Buren was much more strongly influenced by, and nearer to, the principles of Jefferson than had been any of his predecessors.

ISAAC NEWTON CARR. The Relation of the United States with Panama since 1903.

The purpose of this paper is to give a description of the relations of the United States with Panama since the establishment of Panama's independence. Books, current periodicals, and government publications have been used. In order to arrive at some understanding of the relations which have existed between the two countries since 1903, consideration has first been given to the events which led to the establishment of Panama's independence. This has been followed by a topical discussion of relations since that time. The topics are military administration, economic and social conditions, and the enforcement of law and order. The evidence reveals the fact that the United States protects the financial integrity of Panama and shares the greater part of its

trade; that the United States maintains order and guarantees the independence of Panama, and is sovereign throughout the entire territory.

WILLIAM SUMNER JENKINS. The Internal Organization of National Political Parties.

This thesis is a study of the internal organization of national political parties in the United States during the period from 1824 to 1848. The decline of the congressional caucus system of nomination is traced, and the transition methods that were resorted to after its decline are explained. The relation between these methods and the second system, the national convention, is pointed out. Then follows the story of the first three national conventions and the reaction that followed them. The last chapter is devoted to an analysis of the organization and structure of the convention system. In the latter part of the chapter a study is made of the personnel of the conventions, with an attempt to estimate the influence of Congress upon its work.

JAMES WELCH PATTON. Early Applications of the Principles of Extra-Territoriality in China.

The purpose of this thesis is the investigation of so much of our early relations with China as concern the acquisition and application of the right of extra-territoriality in that country. The sources used include the debates of Congress, the executive documents of the Senate and the House of Representatives, newspapers and periodicals, and secondary works. The topics discussed in the development of the subject include: the early relations of the United States with China; the Treaty of Wanghia; its application; and the Treaty of Tientsin. The conclusions of this investigation are that, because of the propitious beginning of their relations with China, the United States were especially fitted for the dominant Western position in that country, but that because of the inefficiency of their home government and because of the incompetence of their diplomatic agents in China the United States lost this place to Great Britain.

C. PERCY POWELL. Political Theories in Colonial North Carolina.

Beginning with the Original Charter of 1663 and concluding with the first State Constitution of 1776 an investigation disclosed the existence of three generally accepted theories of government. The first of these was the contract theory as the basis of government. This was contained in the nature of the Original Charter and stated by the colonists to the effect that in return for their allegiance they were entitled to protection and when either party to the contract denied its obligation the other was no longer bound by it. The second theory was that of the sovereignty of the people. This came out of the seventeenth century English philosophy dealing with the rights of man and was part of the wider movement of democracy. North Carolina was an ideal place for this idea to take root, due, no doubt, to the nature of the people and their manner of development. The third and last of these theories to be accepted was the right of a people to revolt when the government under

which they live becomes oppressive. This theory had an historical precedent in the English Revolution of 1688 and had its manifestation in the American Revolution.

All these theories easily recognized in the governmental documents and political struggles of the colonists in North Carolina were well known among the American colonies generally. North Carolina originated none of them nor even took a place of priority in their advancement largely because of her political conservatism.

DEPARTMENT OF MATHEMATICS

ARCHIBALD HENDERSON has published:

The Triumphs of Relativity. *The Forum,* Volume LXXII, No. 1, July, 1924, pp. 13-21.

The intense interest displayed in the Theory of Relativity since its promulgation by Professor Einstein led to further research on the part of scientists in many lands. Certain experiments tended to confirm, others to refute, the epochal new theory. In the midst of this temporary uncertainty, *The Forum* printed two articles, one in criticism and the other in defense of the theory. In the June, 1924, issue Charles Lane Poor, Professor of Celestial Mechanics, Columbia University, wrote on "The Errors of Einstein." Dr. Henderson's reply, cited above, appeared in the July issue.

William Cain: Mathematician and Engineer. *Journal of the Elisha Mitchell Scientific Society,* Vol. XXXIX, Nos. 3 and 4, April, 1924, pp. 123-130.

Published in connection with the celebration of the fortieth anniversary of the founding of the Elisha Mitchell Scientific Society. An extended survey and technical estimate of the scientific contributions of the former head of the Department of Mathematics, Professor Emeritus and Kenan Professor, William Cain, Sc.D., LL.D.

Is the Universe Finite? *American Mathematical Monthly,* Vol. XXXII, No. 5, May, 1925, pp. 213-223. This paper, on behalf of the Mathematical Association of America, was delivered on January 1, 1925, before the American Mathematical Society, the Mathematical Association of America and Sections A, B and D of the American Association for the Advancement of Science, in joint session, at Washington, D. C.

For some years Dr. Henderson has been making extended researches regarding the possible finiteness of the Universe. He has published a number of papers on this subject. This paper embodies the result of researches made at the University of Berlin, when Dr. Henderson was in consultation with

Professor Einstein. The notion of a finite universe is a direct consequence of the Generalized Relativity Theory. Recent investigations of Silberstein, Lundmark, and Curtis throw considerable light on the subject. On the assumption of the validity of the Generalized Relativity Theory, the available astronomical records of most reliability indicate a "radius" for this finite universe ranging between $6x10^{12}$ and $8x10^{12}$ astronomical units. Dr. Henderson is continuing his researches in this field.

Atomic Structure and Albert Einstein. *Journal of the Elisha Mitchell Scientific Society* (in press).

The autumn of 1923 was spent by Dr. Henderson in residence at Cambridge University, England, on the Kenan Foundation. There he received the benefit of consultations and discussions with Sir Ernest Rutherford, Dr. F. W. Aston, Professor Eddington, and others. Afterwards, at the University of Berlin, he enjoyed the advantage of association with Professor Albert Einstein. This paper is a minute study of the latest discoveries and theories concerning the dynamic model of the atom. It brings out clearly the correlation character of the famous formulas of Niels Bohr and Albert Einstein, and exhibits the connection of Einstein's ideas, including the Theory of Relativity, with the new theory of the atom. The article is illustrated with diagrams and photographs.

The investigations of the finiteness of the universe and the structure of the atom constitute aspects of Dr. Henderson's researches in the entire domain of the Theory of Relativity. These researches have been going forward for some years and were prosecuted vigorously at Cambridge and Berlin. From time to time, as completed, the results of special investigations in this field will be published. Eventually, DR. HENDERSON contemplates publishing all these researches in one volume, dealing primarily with the Theory of Relativity and its most important consequences.

J. W. LASLEY, JR., is continuing his studies in the field of projective differential geometry. He has been engaged during the past year in a consideration of the relations between quadrics which osculate a given ruled surface and its flecnode transforms.

A tangent plane to a surface meets it in a curve with a double point at the point of contact. If the surface is ruled, there are usually two points on each generator at which this double point is both a node and a flex point. These points are known as flecnodes, and their locus gives us two flecnode curves on the surface. The tangents to the asymptotic curves through the points of these flecnode curves generate two ruled surfaces known as the first and minus first flecnode transforms of the original surface. This paper studies the relations between the hyperboloids which osculate the original surface and those which osculate its flecnode transforms.

It turns out that the hyperboloids which osculate the transforms coincide at every generator with that which osculates the original surface, if and only if, the original ruled surface is a quadric. However, even though the surface is not a quadric, it may at some particular ruling closely resemble a quadric. In that event at that ruling the above mentioned hyperboloids coincide, and the hyperboloid is said to hyperosculate the surface. If the surface is not a quadric, nor at the generator in question resembles one, the meet of the hyperboloid which osculates it with the one which osculates a flecnode transform consists of the generator of the original surface and the corresponding one on the transform each counted twice. Under the same conditions the complete intersection of the hyperboloids which osculate the first and minus first transforms consists of the generator of the original surface counted twice and the additional generators picked out by the tangent planes at the complex points.

EDWARD T. BROWNE. General properties of Involutions in n-ray Algebra. Presented before the North Carolina Academy of Science at Raleigh, May 2. The study is not yet complete.

An involution is a projective correspondence of period two. Any matrix, A, not itself a scalar, but whose square is a scalar is the matrix of an involution. All such real matrices arise as the product of a real number by one or the other of the two matrices, B, C, where $B^2 = I$, $C^2 = -I$ (I here denoting the unit matrix). It is the purpose of this paper to make a study of the algebraic properties of real matrices of order n, not $\pm$ I, but which possess the property that their squares are either $+I$ or $-I$. It is clear that for $n>4$ there is no geometric interpretation of the properties of these matrices, so that attention is confined solely to the algebraic properties.

Harold Hilton in his book on Homogeneous Linear Substitutions derives several very important properties of matrices of the above type. In this paper an extension is made of some of the theorems in the above work, and some interesting, and it is believed, new, results have been found. Methods have been found for reducing by means of an orthogonal transformation matrices of the above type to normal, and semi-normal, forms. It is shown that the normal form is unique. Further, there are found necessary and sufficient conditions that there may exist an orthogonal transformation that will carry one matrix of the above type into another.

Two matrices, A and B, of the above type which possess the property that any proper linear combination of them is also a matrix of the above type are said to belong to a linear class. Two such matrices do not in general belong to a linear class. It is the purpose in the latter part of the paper to investigate the conditions under which two matrices will belong to the same linear class.

The Department has approved the following master's theses:

JOHN REAGAN ABERNETHY. Notes in Differential Geometry on the Pseudosphere and its Geodesics.

The purpose of this paper is to give some idea of the character of the pseudospherical surface of the parabolic type, generally known as the Pseudosphere. The chief property studied has been the geodesics.

The method employed has been entirely that of differential geometry. The integral equations have been studied more than the differential equations, i.e., the surface has been studied with reference to its lines rather than as a set of directions through a point.

The geodesics have been studied, their equation derived, and the method of their representation has been discussed. Five typical geodesics have been projected orthogonally on the three coordinate planes. The geodesics have been studied as space curves.

Some associated surfaces have been found. The surface has been represented conformally and geodesically on the plane. The applicable surfaces have been found, and the imaginary sphere has been applied to the pseudosphere.

CLAYTON CARR EDWARDS. The Development of Some Fundamental Principles of Mechanics.

The purpose of this thesis is to give a better understanding of the conception of force in mechanics and a clearer knowledge of two fundamental principles which lie at the heart of this science.

The first chapter is of an introductory nature and is largely concerned with a discussion of the word force in mechanics. The views of Pearson on force as a cause of motion and those of E. Mach on the objective reality of force are fully discussed.

The second chapter deals with the statical principle of Virtual Work. The original history of the principle dating from the time of Archimedes is first given. Then follows some applications which show the extreme utility of the principle. The principle states that a necessary and sufficient condition for equilibrium among a system of forces is that the total virtual work be zero.

The third and last chapter is concerned with the dynamical principle of D'Alembert which states that the external forces with the reversed effective forces acting on a body form a system in equilibrium. The great advantage of the principle is that a dynamical problem can be resolved into a simpler one of statics. Numerous examples of the principle are given showing its wide applicability to various kinds of motions of rigid bodies.

VINTON A. HOYLE. Algebraic Properties of Resultants.

The resultant of two equations f(x) and g (x), of degrees m and n respectively is defined as $a_o^n g(\alpha_1)\, g(\alpha_2) \ldots g(\alpha_m)$, where a_o is the coefficient of x^m in f (x) and the α's are roots of f (x) = O. As thus defined the resultant is a polynomial in the coefficients of the two equations, the vanishing of which is a necessary and sufficient condition that the two equations have a common root.

From this definition are deduced properties of the resultant, two of the most important of which are: the resultant is not equal to the product of two polynomials in the coefficients of the two equations, neither of which is a numerical constant; if, by any method of elimination of x between two equations in x we are led to a condition, F=O, where F is a polynomial in the

coefficients of the two equations, then F contains the true resultant as a factor.

The next portion of the paper is concerned with giving different methods of elimination, and showing what relation their results bear to the true resultant. The most important methods taken up are: Sylvester's Dialytic Method; Euler's Method; Bocher's Method; Bezout's Method. Under Bocher's Method, which is an entirely different approach, is given a method for determining what the common roots are; also many important and interesting facts are proved concerning the resultant.

The next topic taken up is the application of the notion of the resultant to the problem of finding the discriminant of a polynomial, the vanishing of which is a necessary and sufficient condition that the polynomial and its first derivative have a common factor. It is found that the discriminant is the product of a non-vanishing factor by the resultant of the polynomial and its first derivative.

The final part of the paper exhibits a method of finding the roots common to two equations. It is found that any common root is equal to the ratio of the partial derivatives of the resultant with respect to any two successive coefficients of either of the original equations.

DEPARTMENT OF PHARMACOLOGY

W. DEB. MACNIDER has completed the following investigations during the past year:

The Effect of the General Anaesthetics on the Organism as a Whole. *Surgery, Gynecology and Obstetrics,* Vol. XL, 493, 1925.

The use of the general anaesthetics in animals of any age period tends to reduce the alkali reserve of the blood. This reduction becomes more marked as the animal increases in age. In old animals the reduction in the reserve alkali of the blood is associated with a renal injury. Such an injury can be prevented by the judicious use of an alkali or a diet rich in carbohydrates.

The investigation indicates the value of employing the above-mentioned substances prior to the use of the general anaesthetics in the aged.

Concerning the Toxic Effect of Certain Alcoholic Beverages for the Normal and Naturally Nephropathic Kidney. (Accepted for publication in the *Journal for Pharmacology and Experimental Therapeutics.*)

This study points out the relatively nontoxic effect of solutions of ethyl alcohol for the normal kidney and the kidney the seat of certain disease processes of a chronic nature.

Alcoholic beverages made by the fermentation of meal and sugar with yeast are distinctly toxic for both the normal and naturally nephropathic

kidney. The injury is characterized by the appearance of large amounts of albumin in the urine, very few casts and a reduction in the elimination of phenolsulphonephthalein. Retention phenomena are not marked.

Histologically the endothelium of the glomerular capillaries becomes infiltrated with stainable lipoid material. The suggestion is made that such a histological change increases the permeability of the capillaries for albumin and explains the large amount of this material in the urine.

The Protection of the Kidney Against the Injury from Uranium Nitrate by the Use of Sodium Bicarbonate. (Accepted for publication in *The Journal of Metabolic Research.*)

Both normal and naturally nephropathic dogs were employed in the experiments. Following the use of uranium in such animals, the studies demonstrated the ability of sodium bicarbonate when given in the dose of 1 gm. per kilogram to decrease the toxic effect of uranium in both types of animals. The degree of protection was less marked in the naturally nephropathic animals.

Research problems under way:

Concerning the Stability of the Acid-Base Equilibrium of the Blood in Normal and in Pregnant Animals.

The Relative Value of Certain Functional Tests in Determining the Degree and Type of Renal Injury.

The Production of Chronic Experimental Nephritis in the Dog.

SCHOOL OF PHARMACY

E. V. HOWELL has published the following during the year:

Cinara, Carduus, and Scolymus of the Ancients. *Journal of the American Pharmaceutical Association,* December, 1925.

Cultivation of the Opium Poppy in North Carolina. *Journal of the American Pharmaceutical Association,* June, 1925.

The following studies have been made in the Department:

The Action and Remedies for Poison Ivy. E. V. Howell and O. D. Biddy.

Sphagnum as a Surgical Dressing. E. V. Howell and F. S. Goodrum.

Drawings and Measurements of Starch Grains of the Night Shade Family. H. R. Totten and H. A. Moose.

Narcotic Effects and the Coumarin Content of Liatrissima Odorata. H. M. Taylor and E. V. Howell.

County Distribution of North Carolina Drugs. E. V. Howell and R. P. McNeely.

Mercurochome as a General Antiseptic. E. V. Howell and H. L. Rayburn.

Cross-Sections of Malefern and Allied Plants. H. R. Totten and J. P. Hudson.

E. V. KYSER has published:

Some Critical Points of Emulsification in Oil-Soap Emulsions. With Frank C. Vilbrandt. *Journal of the American Pharmaceutical Association,* 5 (1925) 392.

A continuation of studies in which fixed oils are emulsified by the use of soaps as the emulsifying agent. The soaps and emulsions are formed simultaneously upon the addition of oleic acid and the alkalies or alkaline salts. The study shows that sodium and potassium carbonates are superior to the hydroxides or silicates and that relatively small amounts of soaps made from the carbonate reaction produce permanent emulsions.

E. V. KYSER has completed the following to be published in the *Journal of the American Pharmaceutical Association*:

Concerning the Behavior of the Gastro-intestinal Enzymes in the Presence of Certain Antiseptics.

Part 1. Pepsin on Egg Albumen. With C. R. Whitehead and H. Amin.

Part 2. Pancreatin on Starch. With H. E. Whitmire.

Part 3. Pancreatin on Milk. With A. L. Gilreath.

The Inhibitory Action of Antiseptics on the Activity of Diastase. With H. E. Whitmire.

E. V. KYSER has the following studies in progress:

The Menhadden Fish Oils of North Carolina.

The Volatile Oil of Lonicera japonica.

The Volatile Oil of Mentha citrata.

The Volatile Oils and Volatile Oil Plants of the United States. A series of articles with illustrations.

Some Vegetable Oils; their Use in Conjunction with Hydrogenated Oils in the Production of Transparent Soaps. With H. Amin.

Hydrogenated Oils; Their Substitution in the Ointment Bases of the Pharmacopoeia. With A. L. Gilreath.

The Climatic and Soil Conditions of North Carolina for the Cultivation of Bergamot Mint. With H. R. Totten and E. V. Howell.

DEPARTMENT OF PHYSICS

OTTO STUHLMAN, JR., has conducted the following studies during the year:

The Excitation of the M Series in Iron by Electronic Impact. Read at the Washington meeting of the American Physical Society, April, 1924. Published in the *Physical Review,* Vol. 25, No. 234, 1925.

A three-element vacuum tube with tungsten grid was used. In series with the grid was a sensitive galvanometer and a variable potential whose negative terminal was attached to the negative end of the filament. This formed the primary circuit. A high potential with its positive end was attached to the plate and with its negative end to the positive end of the grid battery. This formed the secondary circuit. As a result of the bombardment of the grid by the primary electrons, accelerated by the filament-grid potential, secondary electrons are liberated at critical primary electronic velocities which are detected as a decrease in the galvanometer deflection, because of the flow of electrons from grid to plate through the secondary circuit. The potential current curves thus obtained show sudden discontinuities which are interpreted in the usual way ($hn = eV$). The most prominent excited states thus far obtained and at present located in the M Series of Iron are $\alpha 50$, $\beta 80$, γ or M_1 120, M_2 160, M_3 171 volts.

Models of Elementary Crystal Structure from X-ray Evidence. A paper presented before the North Carolina Academy of Science, May, 1925.

Diamond, graphite, sodium carbonate, white and grey tin and napthaline crystals were constructed using colored wooden spheres and wire frames to simulate the atomic centers and the interspaces. They were made on a scale of 1 inch to the aengstrom unit. The data was obtained from recent contributions by numerous authors.

The Excitation of the O-energy Levels in Tungsten by Electronic Bombardment. A paper read at the North Carolina Academy of Science, May, 1925.

The method outlined in the abstract of M-Series of Iron was used here. The O-energy levels so far identified have values of hn equal to $O_2 - O_1 = .608$, $O_4 - O_3 = 2.96$, $O_5 = 5.20+$ volts. Corrections were made for the work function of W as equal to 4.5 volts.

DR. STUHLMAN has the following studies under way:

Extra-Ultra-Violet Spectra of Iron and Tungsten.

Series spectra discovered in this region are being subjected to a critical mathematical analysis.

Distribution of Velocity in the Electrons at Radiation and Ionization Potentials of Some Metals.

This problem has been partly solved and seems to point to a distribution of velocities according to the Maxwellian Law, especially at low velocity of electronic emissions, i.e., less than 30 volts.

E. K. PLYLER has conducted during the year the following studies:

The Infra-Red Absorption of Ice. *Journal of the Optical Society,* Vol. 9, pp. 545-556, 1924.

The absorption of ice is dependent upon the direction of the plane of polarization for the near infra-red region. Crystals were cut with the optic axis parallel to the surface. Plane polarized radiation was allowed to fall upon the crystal and the per cent transmission determined. The crystal was set in three positions: first, so that the transmitted radiation constituted the ordinary ray; second, so that the transmitted radiation constituted the extraordinary ray; third, so that the incident energy was about equally divided into two rays. For the first position, with a thickness of 5mm., absorption bands were observed at the following wave-lengths with the corresponding per cent transmission: $.81\mu$—55 per cent, $.92\mu$—54 per cent, 1.06μ—46 per cent, 1.29μ—27 per cent. For the second position the values were: 79μ—93 per cent, $.89\mu$—94 per cent, 1.02μ—93 per cent, 1.26μ—57 per cent. For the third position the transmission curve fell between that of the first and second positions and showed both sets of bands. The region from 1.4μ to 1.7μ was studied by using a specimen 1 mm. thick. The position of maximum absorption was located at 1.5μ. The incident energy was unpolarized.

The Growth of Ice Crystals. Presented before the North Carolina Academy of Science, May 2, 1925. *American Journal of Science.* (In press.)

The growth of ice crystals has been studied by many scientists. The writer has explained crystal growth on the basis of the melting between the crystals. This melting has been shown to be due to the absorption of radiation. The larger crystals have a greater heat capacity and thus can refreeze more of the melted liquid. In natural ice the sun's radiation melts the crystal boundaries

and is then cut off at night; under these conditions the crystal growth is most rapid.

DR. PLYLER is now investigating the infra-red absorption of liquids and solids.

J. FENTON DAUGHERTY has in progress:

A Comparison of the Electrode and Electrodeless Spectrum of Iodine.

The following Master's thesis was accepted during the year:

J. FENTON DAUGHERTY. The Electrodeless Ring Discharge in Certain Vapors.

The electrodeless ring discharge proved to be a source of radiation for producing sharp line spectra. The vapors studied were Iodine, Potassium, Sodium, Mercury, and Bromine.

Iodine when worked at a temperature between — 5° C. and 5° C. gave a spectrum of about 80 sharp lines. Potassium with a working temperature of about 250° C. gave about 40 lines. Sodium with a working temperature of about 350° C. gave about 30 lines. The work with Mercury and Bromine was not successful.

This method could be used as a source of sharp lines in the case of most elements where the vaporization takes place at a temperature lower than the melting point of the glass.

DEPARTMENT OF PSYCHOLOGY

J. F. DASHIELL has conducted during the year the following studies:

An Experimental Isolation of Higher Level Habits. *Journal of Experimental Psychology,* Oct., 1924, Vol. 7, pp. 391-397.

The conception of habit as being composed of part-habits of many different degrees of complexity has long been recognized. Definite separation of part-habits of higher and lower degrees by experimental methods has, however, lagged. Here the method was tried of exhibiting some of the higher-level habits directly by training different groups of subjects in habits varying in their simplest component part-reactions, but identical in some of their more general part-reactions. The type of performance chosen was that of substitution. Inspection of the graphed results shows that the group practicing on exactly the same habit day after day improved most rapidly; the group practicing on successive days on habits all similar in general nature but different in the specific elements improved less rapidly; the group practicing successively on habits similar in general nature but in the specific elements half identical

and half different improved least rapidly. At a final sitting a test trial was set in which an entirely new code was given the first two groups. The loss in efficiency for the group that had been practicing on the same habit only was striking.

A Physiological-Behavioristic Description of Thinking. *Psychological Review,* Jan., 1925, Vol. 32, pp. 54-73.

A re-description of the process of thinking was sketched. Thinking involves some substitution of implicit for explicit reactions, especially when the latter are inadequate. These implicit reactions are most consistently described in terms of reflex arcs: thinking being a matter of interacting and mutually influencing motor sets or responses, not of intracerebral shiftings of association impulses. This includes visceral as well as peripheral reactions.

A Re-examination of a Socially Composite Group with Binet and with Performance Tests. (With W. D. Glenn.) *Journal of Educational Psychology,* May, 1925, Vol. 16, pp. 335-340.

An earlier study of samples of the population of the Chapel Hill public school made with the Stanford Revision of the Binet tests showed that the children of faculty parents tended to be superior in intelligence to the children of townsmen, and the latter tended to be superior to the children of countrymen.

In this study an arrangement of the Pintner-Paterson manual performance tests was added to the language type of tests, and the results tended to confirm the difference between the "faculty" and the "town" group, but to question that between the latter and the "country" group. The results were interpreted in terms of differences in opportunity to learn language habits, and, more generally, suggest the need always of adapting the type of test to the previous environment of the individual.

A Program of Research in Constructive Maze Analysis. Presented before a round table of experimentalists of the American Psychological Association, Washington, Dec. 31, 1924.

A program was outlined in which a wide variety of mazes and a checking and measuring of all salient features of each should be employed.

Is the Cerebrum the Seat of Thinking? Presidential address before the Southern Society for Philosophy and Psychology, April 13, 1925.

Additional arguments were presented for the conception of thinking as an exceedingly complex process of adjustments and re-adjustments of motor sets throughout the body generally, instead of as a mere brain process. (This was a further development of the position taken in the article in the Psychological Review, mentioned above.)

A Study in the Direction-Sense of Animals. Presented before the North Carolina Academy of Science, May 1, 1925.

Incidental findings in previous work with animals have been confirmed by the use of a specially planned maze. It was devised so that a variety of pathways led from entrance to exit. Each white rat used quickly learned to find its way to the food exit in trial after trial without error yet *via* a wide variety of routes. As all known objects that might serve as direction-cues were eliminated, the problem arose as to just how the animal was able to maintain a general orientation while going through a series of turns that varied from trial to trial. It was suggested that some motor set may have been established as the animal first enters the maze, and then as it turned to right or to left some compensatory mechanism maintained a tendency to the contrary turn to left or to right until it is actually made.

W. W. ROGERS conducted the following study:

Formation of a Multiple Habit out of Disparate Activities. Presented before American Psychological Association, December 29, 1924.

The experimental study of habit-forming has usually been limited to single habits or else to multiple habits more or less homogeneous. In this study the subject was given three quite distinct tasks to learn to perform simultaneously: with the right hand turning off lights on a switchboard as they successively flashed on, with the left hand sorting blocks (unseen) by dropping them through the proper holes in a brass plate, and with the feet keeping two pedals working continuously. After a few days of difficulty in getting adjusted to the general problem most of the subjects showed both by kymograph tracings and by introspective reports a gradual, though incomplete, integration of the three acts into one act.

The following Master's thesis was accepted during the year:

WILLIAM MURRAY LINKER, JR. Regularity of Learning in a Multiple Unit Maze.

Because of the fact that numerous difficulties are still apparent regarding the types of mazes used in animal psychology and regarding the shape of learning curves obtained, an experiment with a new maze, which has not been widely used, has been carried out in the present study to see whether the learning would be more consistent; and, if so, whether the maze used was reliable according to present standards of reliability.

By taking various criteria of reliability, as given by Heron, Hunter and others, it was possible to compute coefficients of correlation which could be compared directly with those found by these experimenters.

The comparisons of these correlations and of group learning curves and of curves plotted in tenths of learning indicate that the animals did learn more consistently, and therefore, that the maze used in this work has some advantages over other well-known mazes.

DEPARTMENT OF ROMANCE LANGUAGES

STURGIS E. LEAVITT has in preparation:

José Mármol: *Amalia.* (To be published by D. C. Heath and Company as one of a new series of Spanish American novels.)

This extensive novel has been considerably shortened in order to adapt it to school use. In doing so, however, it was possible to keep the main plot practically intact. It contains an historical introduction, notes and vocabulary.

HENRY DEXTER LEARNED has conducted during the year the following studies:

The Retention of Latin Unaccented *a* in French. *Studies in Philology,* July, 1925.

It seems possible to differentiate the treatment of Latin unaccented *a* in internal syllables and its treatment in final syllables, contrary to "Darmsteter's Law." Retention of internal unaccented *a* may be explained satisfactorily for French words by principles which would cause retention of any other vowel as well. Statistics are presented to show that in connected prose three-fourths of all final syllables containing *a* are noun-adjective declensional endings (in Vulgar Latin, nominative or accusative), hence originally (in Indo-European) containing a long *a* of 2 or 3 morae, while the vowels in the endings of other declensions are typically short, or at least shorter, 1 or 2 morae. It is suggested that the original length may have persisted in vulgar speech; that the numerically predominant syllables became typical of all final syllables; and that this original length enabled the *a* to persist after the other (originally shorter) vowels had been dropped.

A Critical List of Old French Loanwords in English to the Death of Chaucer.

The study will include all old French words brought into English while French was actually spoken as a means of everyday intercourse in England; it will note their possible dialectal criteria (Norman, Picard, etc.), attempt to localize and explain dialectal forms, and bring together all available information with a view to illuminating this still relatively little explored part of the English vocabulary.

N. B. ADAMS has at present in the hands of publisher:

El Abencerraje. Modernized text of the edition published in the *Inventario* of Antonio de Villegas at Medina del Campo in 1565, notes and vocabulary. In collaboration with Mrs. Gretchen Todd Starck.

PROFESSOR ADAMS has in preparation:

Notes on the Advent of the Romantic Drama in Spain.

El Trovador. Text, notes, and vocabulary. (In collaboration with Mrs. Gretchen Todd Starck.)

The following Master's theses were accepted by the Department during the year:

AGATHA BOYD ADAMS. The "Pastelero de Madrigal" in Nineteenth Century Spanish Literature.

When King Sebastian of Portugal disappeared in 1578 after the battle of Alcazar-Kivir, a legend arose that he had not been killed, but was in hiding. Taking advantage of the popular belief that he would return, various impersonators of the king appeared to claim the throne. One of these, Gabriel de Espinosa, who followed the trade of pastry cook in the village of Madrigal, was the most famous of the group, and several versions of his story appear in Spanish literature, especially in the nineteenth century.

The earliest account of Gabriel de Espinosa's adventure is given in an anonymous *Historia de Gabriel de Espinosa,* published in 1595, the year in which the pastry cook was hanged, and purported to be the account of an eyewitness. The first literary treatment of the story is to be found in *El Pastelero de Madrigal* (1650?), by Jerónimo Cuéllar. Both of these works are important sources of the nineteenth century productions on the same theme.

The pastry cook of Madrigal reappears three times in nineteenth century Spanish literature: in Patricio de la Escosura's novel *Ni Rey ni Roque* (1835), José Zorrilla's drama *Traidor, Inconfeso, y Mártir* (1849), and Manuel Fernández y González's novel *El Pastelero de Madrigal* (1862). The first of these authors, Escosura, like most of the Spanish writers of his time, was considerably influenced by Sir Walter Scott, and his account of the career of Gabriel de Espinosa is given much in the Waverly manner. The sources of his information are to be found in the anonymous *Historia de Gabriel de Espinosa* and in Cuéllar's play. The second work, which Zorrilla himself considered his best play, identifies the pastry cook with the lost king of Portugal, and portrays in masterly style his arrest and execution at the order of Philip II. For his historical data the poet probably drew from Escosura's novel. Fernández y González's romance is a rambling *folletín* of more than fifteen hundred pages, in which the author combines with many episodes of his own imagining much that had been previously written about the pastry cook and the king.

KITTY LEE FRAZIER. Estimates of Molière by his Contemporaries.

Usually the value of a work is determined by the judgment of posterity, but contemporary opinion is no less important. An immediate view takes into account many significant details which are lost in a distant perspective. Therefore, the writer undertakes to bring together the criticisms of Molière, both favorable and adverse, which were made during his lifetime, and to group and condense what hitherto could only be found dispersed among many works, in order to show how Molière impressed himself upon his age and to what extent his contemporaries were aware of his great genius.

The principal authors quoted are: Boileau, Bourdaloue, Bossuet, La Fontaine, La Bruyère, Saint-Evremond, Tallemant des Reaux, and Vauvenargues.

A brief biographical sketch of Molière is given; special attention is paid to the time of production of each of his plays, the occasion of its performance and the length of its run. This affords a background for the introduction of the criticisms, allowing them to be set forth in chronological order, thus placing each in its proper setting. In the second chapter the final estimates of Molière by his contemporaries are given, concluding with those epitaphs by La Fontaine and Robinet in which he is recognized as the true father of French Comedy.

DEPARTMENT OF RURAL SOCIAL-ECONOMICS

Farm Life Abroad is the title of a book containing thirty-six chapters on the country end of life in Germany, Denmark, and France, written by E. C. Branson during his year's leave of absence abroad, and published upon his return to the University.

The newly published *Year-Book* of the North Carolina Club, 1924-1925, contains thirteen chapters under the title of "What Next in North Carolina". A list of the chapters appears elsewhere.

The *University News Letter,* which goes weekly to about eighteen thousand people, carried tables and brief interpretations of twelve research studies of state-wide significance, and twenty-two studies of nation-wide interest.

A list of research studies prepared under the direction of the Department of Rural Social-Economics during the college year 1924-1925 follows:

COUNTY STUDIES

1. Alamance County: Industries and Opportunities, by A. E. McIntyre, Alamance County.

2. Davidson County: Economic and Social, Ten Chapters, a 3,000 edition published and distributed, by Miss Jewel Sink, Davidson County.

3. Mecklenburg County: Industries and Opportunities, by J. J. Rhyne, Gaston County.

4. New Hanover County: Facts about the Folks, Food and Feed Production, Natural Resources, by D. B. Koonce, New Hanover County.

5. Orange County: Facts About the Folks, Wealth and Taxation, by Miss Elizabeth Branson, Orange County; Historical Background, Farm Conditions and Practices, by Miss Elizabeth Ellen Bland, Orange County; Natural Resources, Schools, by Miss Ada Thompson, Orange County.

6. Pitt County: Wealth and Taxation, Agriculture, by W. M. B. Brown, Pitt County.

7. Robeson County: Facts About the Folks, Wealth and Taxation, Schools, Evidences of Progress, Problems and Solutions, by F. LeV. Adams, Robeson County; Historical Background, The Indians of Robeson County, by W. D. Coxe, Robeson County; Natural Resources, Agriculture, W. T. Sinclair, Robeson County.

8. Union County: Schools, Agriculture, by F. O. Yates, Union County; Historical Background, Facts About the Folks, Wealth and Taxation, by J. M. Redwine, Union County.

9. Wayne County: Facts About the Folks, Schools, by Miss Elizabeth Collier, Wayne County; Food and Feed Production, Natural Resources, Wealth and Taxation, by J. B. Lane, Union County.

STATE STUDIES

1. Birth and Death Rates in North Carolina and in the United States, 1922 and 1923—C. H. Yarborough, Franklin County.

2. Population Studies, based on the 1920 Census—R. O. Moye, Pitt County.

3. Agricultural Organization in North Carolina—W. D. Allen, Halifax County.

4. County Health Administration in North Carolina—L. P. Barnes, South Carolina.

5. State Health Administration in North Carolina—Z. B. Newton, Cumberland County.

6. Rural Manufactures of North Carolina—R. G. Little, Pitt County.

7. History of Agriculture in North Carolina—A. M. Stainback, Guilford County.

NORTH CAROLINA CLUB STUDIES

1. Non-Voting Democracies, Miss Ruth Hunter, Virginia.

2. Local Responsibility for Social Problems, Miss Elizabeth Branson, Orange County.

3. Efficiency in County Government, Paul W. Wager, Orange County.

4. State-Aid to Landless Farmers, Reed Kitchin, Buncombe County.

5. Does North Carolina Read? Orlando Stone, Virginia.

6. The Consolidated School as a Civic Center, Paul W. Wager, Orange County.

7. Tax Problems of North Carolina, C. G. Grady, Johnston County.

8. The Basis of Taxing Land Values, B. B. Wright, Cleveland County.

9. Revaluation in North Carolina, A. M. Scarborough, Lenoir County.

10. Trunk-Line Freight and Passenger Traffic with the Upper Middle West, R. B. Eutsler, Virginia.

11. A Spiritual Awakening in North Carolina, J. O. Bowman, Orange County.

12. A State System of Port Terminals and Water Transportation in North Carolina and Other States, W. T. Couch, Orange County.

13. Freight-Rate Discrimination Against North Carolina, G. K. Cavenaugh, Johnston County.

SPECIAL RESEARCH STUDIES

County Government in Alamance County, by Paul W. Wager and Brandon Trussell.

County Government in Stanly County, by Brandon Trussell.

County Government in Edgecombe County, by Paul W. Wager.

County Government in Macon County, by Brandon Trussell.

County Government in Surry County, by Paul W. Wager.

Twenty Years of Progress in Negro Education in North Carolina, by H. H. Huff.

The following Master's Theses were accepted during the year:

HERBERT HENRY HUFF. Twenty Years of Progress in Negro Education in North Carolina.

The negroes in North Carolina, between 1902-1924, increased 67 percent in school enrollment, 75 percent in average daily attendance, 69 percent in length of school term, 1,552 per cent in the value of school property, and 652 percent in salary funds for teachers. The average amount spent per child in daily attendance is $11.90 for colored and $28.20 for white. The increase in the amount spent per child, in the value of school property, and in the salary funds for teachers has been more than 50 percent greater for the white child than for the colored child. But in the length of school term, in the enrollment, and in the average daily attendance the increase is closely correlated between the two races. The negroes are about one decade behind the white people in educational equipment and conditions, yet they are making creditable and commendable progress.

BRANDON TRUSSELL. County Government in Stanly County with Suggestions for its Improvement.

County government is an unexplored field. With this in mind a study of county affairs was made in Stanly County for the purpose of revealing the weaknesses of the county government and to pave the way for the reconstruction of county government throughout the state. In Stanly County the same antique system inaugurated more than one hundred years ago is still followed. Every department of county government is managed according to the rules of a well established custom which is out of harmony with our age. Tax assessing, tax collecting, and public expenditures are not made according to the most approved business methods. The various institutions of the county are under the supervision of untrained men. The county is under the management of a group instead of a highly-trained expert manager. This is an economic disadvantage to the people since the cost of county government continues to increase without a corresponding increase of public service.

DEPARTMENT OF SOCIOLOGY

HOWARD W. ODUM has published during the year the following:

The Negro and His Songs (with Guy B. Johnson). University of North Carolina Press.

Sociology and Social Problems. American Library Association.

Southern Pioneers (edited). University of North Carolina Press.

Public Welfare and the Community. University Extension Division Bulletin.

He has contributed the following:

A More Articulate South, *Journal of Social Forces,* September, 1924.

G. Stanley Hall: Pioneer in Scientific Social Exploration, *Journal of Social Forces,* November, 1924.

Masters of Work, *Journal of Social Forces,* January, 1925.

University Research and Training in Social Science, *Journal of Social Forces,* March, 1925.

A Southern Promise, *Journal of Social Forces,* May, 1925.

He has in preparation:

Systems of Public Welfare (with D. W. Willard), to be published in September, 1925.

Masters of Social Science; Negro Singers in the South; The Study of Social Problems.

JESSE F. STEINER is publishing this fall "Community Organization." The Century Company.

Theories of Community Organization, *Journal of Social Forces,* November, 1924.

A Critique of the Community Movement, *Journal of Applied Sociology,* November-December, 1924.

MR. STEINER is preparing a source book on "Theories of Community Organization" and continuing his studies on Community Disorganization.

HAROLD D. MEYER has directed researches into state-wide programs of recreation in Mississippi and North Carolina.

MR. MEYER is making a special study of the Parent-Teachers Association in relation to the pre-school child.

GEORGE H. LAWRENCE has made "A Study of the First One Hundred Cases of Mothers' Aid in North Carolina."

He has in preparation the following:

A Study of Outdoor Poor Relief in Chatham County; The Rochell Family: A Study in Feeble-Mindedness; A Ten-Year Study of the Boys of Jackson Training School.

GUY B. JOHNSON has published "The Negro and His Songs" (with Howard W. Odum), University of North Carolina Press.

Newspaper Advertisements and Negro Culture, *Journal of Social Forces,* May, 1925.

MR. JOHNSON is making a special study of the approach to the American negro problem through the process of segregation.

ROY M. BROWN is continuing his special research into problems of poor-relief in North Carolina.

The following Master's Theses were presented in June, 1925:

MABEL BOYSWORTH. Leisure-Time Activities of Adolescents in North Carolina.

The purpose of this study was to determine the amount of spare time adolescents in country, town, or city have; what their chief interests are; how and where they actually spend their leisure time; and what agencies closely associated with them seem to be reaching the largest number of adolescents during their leisure time.

The individual questionnaire method was used. The questionnaires were distributed at random among high school students, and are fairly representative of the different sections of the state.

As a background to the actual study of 819 individual cases, a survey is made of the significance of the adolescent age and the present problem of meeting adolescent interests during their spare time. Special attention is given to the situation in North Carolina. The tabulation and interpretation of the 819 questionnaires show, among other things, that:

1. The average number of leisure hours each week, excluding Sunday, is 22 for boys and 20.5 for girls.
2. Much loafing occurs in towns as well as in cities.
3. Adolescents in the country and in the small towns need as much recreational supervision as in the cities.

4. Little club life aside from that of church and school is provided for adolescents.

5. From the trend of group life there appears a direct tendency for the school and church to supplant the home as centers of group activity.

6. 75.6% of the boys and 89.7% of the girls in the group are members of the church and take some part in church activities.

7. Over 90% of both boys and girls state they like to read. Boys prefer adventure; girls prefer love stories.

8. A marked need exists for more coöperative games which would develop team-play and loyalty.

9. Some form of out-door life represents one of the chief interests of both boys and girls.

10. The attitudes and opinions as expressed by the boys and girls do not indicate a marked tendency toward the impropriety and indifference often attributed to the young people of today.

11. Indications show that adolescents desire leadership with training, experience, and personality.

ROY EUGENE BROWN. Town Government in North Carolina.

The study of town government in North Carolina leads into a field that has scarcely been touched. The problem has, therefore, been to find what the legal basis of town government is and what forms are actually in operation.

The only satisfactory approach to the problem has been through an analysis of general municipal regulations, working town charters, and legislative procedure in providing for these regulations, charters and charter amendments.

A preliminary survey of the situation revealed three significant facts: First, that there is little available information to form the basis for intelligent legislation and no effort to provide a progressive program of town government for 441 towns of less than 5,000 population. Second, that legislative methods for providing such regulations are unsatisfactory and both general and private bills for municipalities slip through the legislature without proper consideration. Third, that the majority of these towns continue to adhere to the old aldermanic and councilmanic forms of government with many variations and irregularities.

The study indicates that with a thorough analysis of the actual workings of the governments of individual towns, a sound basis for better town government may be laid.

CORDELIA COX. A Study of the Needs of Rural Educational and Vocational Guidance in Elementary Schools.

The purpose of this paper has been twofold: first, to discover vocational trends among rural girls; and second, to determine if there is any considerable body of information which, if brought to girls in rural elementary schools, will aid them in choosing vocations wisely and in properly equipping themselves for these vocations.

Data were gathered through personal visits to sixty-five schools and twenty homes in two North Carolina Counties. Supplementary statistical information

was secured through the State Board of Education. At the close of the study, a brief experimental course in educational and vocational guidance was given in a consolidated school.

The tentative conclusions were as follows:

1. Of the girls between the ages of fourteen and twenty-five not in public schools on whom data were secured 41.5 per cent are "staying home", 14.8 per cent are marrying, 13.1 per cent are teaching, 9.6 per cent are working in factories or mills, 7.4 per cent are in vocational schools or colleges, 5.2 per cent are clerking, 8.4 per cent are cooking, sewing, going into business, etc.

2. There is a real need for educational and vocational information in consolidated rural schools.

3. In small rural schools other more basic needs must be realized before vocational information will be of value.

The research represented in this report is the beginning of a more extensive study, covering a wider area of the vocational trends of country boys and girls.

KATE FULTON. Adolescene Leisure-Time Activities in Mississippi.

The purpose of this study was to gather scientific information concerning adolescent's leisure hours, to discover whether specific peculiarities are explainable in the trends and tendencies of a period, to determine, if possible, whether the interests and activities of this period are adequately provided for or not, and to outline a constructive program.

Individual questionnaires distributed at random among high school boys and girls in all parts of the state were used as a basis for this study.

The survey, taken as a whole, shows that adolescent boys and girls have a great amount of leisure time, the boys having more than the girls. Some of the most constructive activities are neglected. Club life and social life in general is rather limited, especially in the rural districts. The ratio of social activities fostered by the home and church is comparatively low. The majority of adolescents like to read, but a very large number read "popular fiction" magazines rather than boys' and girls' magazines. A large percentage of adolescents are church members, but more girls than boys. Very large numbers are not members of young people's organizations in the church, however, and do not attend church regularly. Boys have more major sports than girls. The average number of playground games is greater for girls than for boys, yet many do not play any at all. Some sections are almost entirely dependent on the school playground for out-of-door recreation. Probably contrary to the usual opinion, modern tendencies in leisure-time activities of adolescents characterize the town rather than the city.

All of these conclusions point to the fact that in order to provide equal and adequate opportunities for all boys and girls, a more extensive program of welfare work should be planned.

COYLE ELLIS MOORE. Social Aspects of County Organization.

The technique of social work, as it exists today, has been evolved, almost wholly, from city and town life and conditions. Thus a need has arisen for

the development of a method for rural social work. This evident need called forth the present study of rural leadership. The study for the present has been limited to one hundred rural leaders of Orange County.

The purpose of this study is threefold: (a) it is to be the basis of a future study for the evolving of a technique of rural social work; (b) it shows the relation of rural leadership to the larger field of community organization; and (c) it furnishes valuable material on one phase of the general problem of southern leadership.

The country community does not exist in Orange County. There are neighborhoods centered around the country church, the country school, and the country store. Rural people are bound by neighborhood ties and think in terms of such interests. The positions of leadership are bound up in neighborhood groups and institutions and the leaders make articulate the feelings and attitudes of the group.

The three possible centers of country community life in Orange County are the consolidated school, the country church, and the small town. Of the five consolidated schools in the county only one has made any effort to serve as a community center because consolidation has been too recent. The country churches are too weak to serve as centers of country community life. Their membership is small and the community is often divided into factions on account of sectarian strife and family bickerings. There are no organizations within the church except the Sunday-school which closes during the winter months No rural church has a full-time resident pastor and thus cannot occupy its rightful place as a center of community life. The small towns of Hillsboro, Carrboro and Chapel Hill do not attempt to be centers of country life. They are pactically devoid of rural service features.

The rural leaders are old residents of the county, most of whom have lived in the community all of their lives. They are the descendants of slave owners and their fathers held positions of leadership in the community. Their training for the position of leadership has been limited, and their wealth is not sufficient to enable them to devote their time to the service of the community without compensation.

JENNINGS JEFFERSON RHYNE. The Place of the Social Studies in Mill-Village Schools.

With the historical development of textile manufacturing in the South as a background, the thesis sets forth some of the more important problems that have developed along with the industry. Gaston County, North Carolina, has more cotton mills than any other county in the United States and more spindles than any other county in the South. For this reason it was selected as a basis for this study.

The facts gathered through this study of one hundred cotton-mill families represent but a step in the accumulation of a larger body of facts bearing on Southern mill village life and people.

The public-school system offers opportunity for the development of leadership among mill village people. Social education, through the institution of a well organized program of social studies in mill village schools, has as one

of its aims the development of local leadership, an outstanding need among cotton mill operatives. The social studies in mill-village schools are designed to furnish a program that will provide the training in citizenship necessary if the boys and girls are later to assume the role of leadership.

The program of social studies outlined at the conclusion of this study represents a radical departure from the present curriculum in mill-village schools. The social studies must be placed in grades four to seven if the majority of mill children are to receive the training in citizenship before they drop school. The curriculum of the four grades should be organized on the departmental basis, in order that it may be possible to secure thoroughly trained teachers for each branch of the social studies. Finally, the materials in the several studies should be coördinated to the greatest possible extent.

ELIZABETH GIBSON SMITH. Public Welfare Problems of Chapel Hill.

This survey was made with the object of analyzing the existing conditions in Chapel Hill from the public welfare viewpoint.

It was found that the following problems were the most outstanding: first, the existing condition of the marginal families which seem to form a ring around the outer edge of the town presented all forms of family maladjustment; second, nearly all recreation was found to be on a commercial basis, with a distinct absence of playgrounds or supervised recreation, except that supported by the school; third, the various organizations of Chapel Hill are too busy with their own affairs to give proper consideration to the welfare of the town as a whole; fourth, the non-enforcement of municipal ordinances is especially noticeable in the matter of stables, outside toilets, and garbage collection; fifth, a conservative attitude toward progressive health work was noted.

The existing negro problems were dealt with as a separate unit. Small negro families seemed to be the rule rather than the exception. Based on the 735 negroes in the town limits, it was found that the average-size family was 3.8, and the average number of children per family for the 191 negro families was 1.5. Of the 156 negro families that lived in separate houses, 91 owned and 65 rented their homes.

ORLANDO STONE. Reading Habits of North Carolinians as Indicated by Several Indices.

The purpose of this study was to measure objectively the reading propensity of the people of North Carolina by considering her rank among the states in various phases of the problem of reading.

The results of the study reveal that North Carolina ranks forty-third in reading daily newspapers; thirty-seventh, in respect to population, in the number of volumes in college libraries; fortieth in the percentage of people having access to public libraries; and forty-eighth, relative to total population, in the number of volumes in public libraries that have five thousand or more volumes.

Also the study has shown that library facilities in public schools in rural districts in North Carolina, as represented by those of Chatham County, are meagre and in many schools non-existent.

A very definite relationship or high positive correlation has been found to exist between reading and other measures of progress, such as an efficient school system, estimated true wealth per inhabitant, and percentage of illiteracy. In order to change the present status of North Carolina in reading, it would be necessary to establish more adequate schools for training librarians; to create more efficient secondary school libraries, meeting the needs of the children; and to develop a county-wide system of public libraries supported by taxation.

DEPARTMENT OF ZOOLOGY

H. V. WILSON on the invitation of the Carnegie Institution is preparing to take up at the Tortugas (Florida) Laboratory an investigation on the regenerative powers of dissociated sponge cells. That sponges and some other lower organisms (hydroids) may be broken up into their constituent cells and the latter made to reunite and form new organisms was discovered by Professor Wilson at the Beaufort (N.C.) Laboratory some years ago. The method lends itself to hybridization experiments and the possibility of working successfully along this line at Tortugas will be tried out. An independent investigation along the same line will be conducted by another investigator in the Bermudas.

R. E. COKER has continued studies of freshwater crustacea in North Carolina, a first report being practically ready for publication. He completed for publication a joint report (of which he was co-author and editor) on the Fauna of Penikese Island in 1923. This study, undertaken in commemoration of the fiftieth anniversary of the founding of Agassiz's Laboratory on Penikese, was made by a group of biologists associated with the U. S. Fisheries Biological Station and the Marine Biological Laboratory at Woods Hole, Mass. The report has been accepted for publication in the *Biological Bulletin.* As acting chairman for the present of a Committee on Aquiculture of the National Research Council, he began an inquiry intended to throw light on the possibilities of maintaining and increasing the productivity of freshwaters and to point out underlying scientific problems that require investigation.

W. R. EARLE. A Simple Apparatus and Method for the Injection of Early Chick Embryos. *Journal of the Elisha Mitchell Scientific Society,* Vol. XL, No. 171, December, 1924.

The apparatus used is a combination of binocular miscroscope with mechanical stage, ordinary microscope, and long lens holder to which a bent pipette is lashed. The component parts are, thus, such as are found in every laboratory.

W. R. EARLE is occupying during June and July a research table at the Beaufort (N. C.) laboratory of the U. S. Bureau of Fisheries.

The following Master's thesis was accepted in 1925:

JAMES THEOPHILUS PENNEY. A Comparative Study of the Origin of the Yolk Protoplasm and Yolk Protoplasm Nuclei in the Bony Fishes.

Old theories of the origin of the yolk protoplasm ("periblast," "parablast") are stated, all of which give way to the prevalent theory that the yolk protoplasm and nuclei are derived from the cells of the segmenting blastoderm.

Kopsch describes three modes of origin: first from the marginal cells of the blastoderm, second from the under layer of cells of the blastoderm, and third from a combination of both.

In the first class, the first segmentation furrow does not reach the yolk, the first two blastomeres being connected by a thin layer of protoplasm. This is the primary yolk protoplasm and it persists, connecting the marginal cells which later lose their cell boundaries and which fuse with each other and with the yolk to form the marginal part of the yolk protoplasm. This is the classical method.

Origin of yolk protoplasm from the under layer of cells is theoretically possible but as yet unproved.

Origin of yolk protoplasm from marginal cells and from the under layer of cells of the germ presents two types, first that found in the trout, and second that found in L. Reinhard's description of the development of Scardinius.

In the trout none of the first six furrows reach the yolk. After the fifth division (horizontal) there is an upper layer of blastomeres and a lower syncytial layer. This is the primary yolk protoplasm.

In Scardinius the first furrows completely divide the blastoderm. After the blastoderm is several cell layers thick, the marginal cells fuse with the yolk to form marginal yolk protoplasm, and the under layer of cells of the blastoderm dig into the yolk, fusing with it to form the central yolk protoplasm.

The eggs of *Fundulus heteroclitus* and *Stenotomus chrysops,* which were artificially fertilized, were studied from preserved material. The yolk protoplasm in both species develops according to the classical manner. One case is presented where cells of blastodisc are fused with the yolk protoplasm. It is possible that this is an abnormality.

BUREAU OF PERSONNEL AND VOCATIONAL INVESTIGATION

T. A. WHITENER, as Director of the Bureau of Vocational Information, has continued this year his study of some factors involved in the guidance of college freshmen. The parents' vocations and the freshman's vocational choice have been studied in relation to each other and in relation to mental alertness scores.

F. F. BRADSHAW has been engaged in the following items of a personnel research program:

1. General study of the Class of 1926 from the family and preparatory school background on through the University and then as long after graduation as possible and profitable, with especial emphasis upon outstanding successes and failures as related to home influences, preparatory school record, curricular and extra-curricular activities, intelligence quotient, self-help status, attendance and health record, etc.
2. Relation between early collegiate success and high school training as shown by high school grades and fall term grades.
3. Analysis of cases of students who fail to complete their course in terms of intelligence quotient, sick report, parents' explanation, roommates' and classmates' explanations, grades, and attendance records.
4. Analysis of cases of disciplinary suspensions in terms of grades, intelligence quotients, and attendance records.
5. A study of the intelligence test scores of 436 students reported for giving bad checks, and a comparison of these scores with the scholastic grades of this group. This study was made for the group as a whole, as well as by classes. The average intelligence of the entire group was above the average for the student body, and the average grades, below.
6. A study of the distribution according to the Otis Intelligence Test of 22 juniors making Phi Beta Kappa by averaging "B" or better for three years.
7. Continuing the comparison between the Otis test scores and freshman records, begun in 1921-22, continued with that test until the present year, and transferred this year to the Co-operative Test.
8. A comparison of extra-curricular student achievements and intelligence tests. This has proceeded farther in the case of freshman athletics than any other activity. In general, freshman athletes are above the average of their class in intelligence and below it in scholastic achievement.

INSTITUTE FOR RESEARCH IN SOCIAL SCIENCE

Beginning in the fall of 1924, the University of North Carolina inaugurated the Institute for Research in Social Science with a spe-

cial organization and with provisions for research assistants, secretarial help, field expenses, and library facilities adequate to undertake exhaustive research into special problems approved by the Directors. The subjects for research are chosen in the field of the social sciences, ignoring departmental lines, and working toward a larger correlation of both departments and subjects. The Institute has been made possible by a three-year grant by the Laura Spelman Rockefeller Memorial Foundation. The following investigations are in progress:

Under the direction of E. C. BRANSON, Kenan Professor of Rural Social-Economics:

BRANDON TRUSSELL has been studying the organization, function and administration of county government and county affairs in North Carolina and has made special investigations in Alamance, Stanly, and Macon Counties.

PAUL W. WAGER has made special investigations in Alamance, Edgecombe and Surry Counties in connection with his study of the organization, function and administration of county government and county affairs.

MYRON GREEN will assist in continuing and furthering these investigations of county government and county affairs during the coming year.

Under the direction of J. G. DER. HAMILTON, Kenan Professor of History and Government, and R. D. W. CONNOR, Kenan Professor of History and Government:

GUION GRIFFIS JOHNSON is making an exhaustive study of social conditions in North Carolina from 1800 to 1860.

FLETCHER M. GREEN will make a special study of factional politics in Georgia.

WILLIAM S. JENKINS will investigate similar problems of sectionalism in North Carolina to correlate with Mr. Green's researches.

EDWARD J. WOODHOUSE will study North Carolina towns with special emphasis on municipal programs.

J. G. DER. HAMILTON has under way researches in the emigration of southern leaders to other sections.

Under the direction of M. L. FERSON, Professor of Law and Dean of the School of Law:

ROBERT A. MCPHEETERS will carry on researches relating to the social value of legislation, such as industrial accidents and the need of workmen's compensation.

CHASE GOING WOODHOUSE will make a comparative study of social legislation in North Carolina.

Under the direction of A. M. JORDAN, Professor of Educational Psychology:

W. D. GLENN, JR., will continue his researches in physical work and mental growth in relation to children in mill and country communities—a study of the effect of work on the mental growth of children in mill villages and rural areas.

WILLIAM O. HAMPTON will make special studies of physical defects and diseases prevalent among the public school children of North Carolina, the prevalency of each condition, and the effect which these conditions have on the school progress and mental development of the children.

Under the direction of T. L. KIBLER, Professor of Economics and Transportation:

ROLAND B. EUTSLER has been studying transportation problems in North Carolina—an interpretation of the factors shaping these activities as a basis for determining the most desirable transportation policy for North Carolina.

Under the direction of DUDLEY DEWITT CARROLL, Professor of Economics and Dean of the School of Commerce:

CECIL K. BROWN will continue the study of transportation problems in North Carolina.

HARRIET HERRING will make a detailed investigation and a comparative study of labor turnover and personnel management in cotton mills.

Under the direction of HOWARD W. ODUM, Kenan Professor of Sociology and Director of the School of Public Welfare:

ROY E. BROWN has made a study in the municipal and social problems of the small town in North Carolina.

GUY B. JOHNSON is preparing source materials for the study of the American Negro with the emphasis upon the approach to the processes of race segregation.

LIDA CLEVELAND EDMISTER is proceeding with an information and service inquiry—a preliminary study analyzing for one year the total number of calls for information and service made upon the University. KATHARINE JOCHER is compiling a manual of social research which will summarize method, sources and simple technical means of research, with special reference to Institute problems and methods. HOWARD W. ODUM and GUY B. JOHNSON have published *The Negro and His Songs,* University of North Carolina Press, 306 pp. They will bring out the second volume in the fall.

HOWARD W. ODUM has published *Southern Pioneers,* University of North Carolina Press, 221 pp. A similar volume on *Social Progress in the South* is in preparation for early publication.

HOWARD W. ODUM and D. W. WILLARD now have in press *Systems of Public Welfare,* a study of current public welfare administration in the United States.

Under the direction of J. F. ROYSTER, Kenan Professor of English Philology and Dean of the College of Liberal Arts:

ELIZABETH LAY GREEN is proceeding with her study of Folk-ways in central North Carolina—a study of the relation of folk-lore to the social condition of the rural people.

Under the direction of L. R. WILSON, Kenan Professor of Library Administration and Librarian:

ORLANDO STONE has made a study of reading habits of North Carolina and the South—an investigation of the general subject of reading in the South, especially in North Carolina.

RESEARCH ORGANIZATIONS

THE ELISHA MITCHELL SCIENTIFIC SOCIETY

The Elisha Mitchell Scientific Society, composed of faculty and advanced students from the scientific departments of the University numbered for the year 1924-1925 193 members (68 active and 125 associate). The officers of the Society were: *President,* Otto Stuhlman, Jr.; *Vice-President,* H. R. Totten; *Permanent Secretary,* J. M. Bell; *Recording Secretary and Treasurer,* Joel H. Swartz; *Editors of the Journal of the Elisha Mitchell Scientific Society,* W. C. Coker, J. M. Bell, and Collier Cobb. Seventeen papers were presented at the eight meetings held during the year, all by members of the University faculty. The complete programs and abstracts of most of the papers not appearing elsewhere in this bulletin are given below.

Programs of the Elisha Mitchell Scientific Society, during 1924-1925.

274th Meeting, October 14, 1924.

Collier Cobb. The Deflective Effect of the Earth's Rotation as Shown in the Loess Plain of China.

Otto Stuhlman, Jr. The Atom. What Is It? (Presidential Address).

275th Meeting, November 11, 1924.

J. M. Bell. Electrometric Methods of Chemical Analysis.

A brief outline was given of the theory of electrometric titrations, involving the detection of end-points by voltage readings between electrodes in the titration mixture. The advantages and disadvantages of the method were reviewed.

D. A. MacPherson. The Relation of Hydrogen Ions to Bacteria and Public Health.

276th Meeting, December 9, 1924.

E. W. Atkins. The Efficiency of the Eye Under Different Intensities of Illumination.

Subjects worked at a rather routine task under five different intensities of illumination. The rate and constancy of the work was taken as a measure of the work done under the differing illuminations. The condition of the subjects was determined by pulse records and by coordination tests before and after the work. The same type of work, series of condition tests, and

brightness of test object was later employed with a substitution of white surroundings (coefficient of reflection 90%) for the black surroundings (coefficient of reflection 4%) of the first condition.

It was found with black surroundings that the optimum brightness of the test object was about 37 millilamberts. It is interesting that this brightness closely approximates the maximum brightness of a surface reflecting sunlight. This brightness was shown to be far too great in case the surroundings as well as the test object were light instead of dark.

W. C. COKER. The Puff-Balls and Their Relatives.

The most of the main groups of the *Gastromycetes* were described and illustrated, with particular attention to the varied methods of spore dispersal.

277th Meeting, January 13, 1925.

W. C. GEORGE (with DR. W. E. HOY, JR., of the Presbyterian College of South Carolina). Somatic Chromosomes of the Opossum. (Abstract appears on page 5.)

ARCHIBALD HENDERSON. Relativity and Atomic Structure. (Abstract appears on page 58.)

COLLIER COBB. Brief Notice on a Combustible Clay from Ontario, Canada. (Abstract appears on Page 50.)

278th Meeting, February 10, 1925.

WILLIAM CAIN. Maxwell's Theorems of Relative Displacements.

The three well-known theorems entitled, "Maxwell's Theorems of Relative Displacements," were proved, for supported beams, by Clerk Maxwell by the "method of work." The case for the cantilever, or beam or arch-rib fixed (*encastrée*) at one end, free at the other, is simpler; and Maxwell's three theorems have been proved by the writer in an original manner, by aid of certain theorems of elasticity, for such cantilevers. The solution does not involve "the method of work" and is simpler than Maxwell's solution and entirely distinct from it.

In the solution of the usual arch-rib without hinges, the three theorems for the cantilever are utilized in finding the reactions and consequent stresses anywhere in the arch, so that it seemed that an independent proof of Maxwell's Theorems for the cantilever for the load having any direction would be welcome.

E. K. PLYLER. The Infra-Red Absorption of Ice. (Abstract appears on page 65.)

279th Meeting, March 10, 1925.

T. F. HICKERSON. Vertical Curves of Greater Flexibility for Highways and Railroads. (Abstract appears on page 14.)

A. H. PATTERSON. Structure of the Atomic Nucleus.

A brief account was given of the methods of attack on the problems connected with the nucleus; its size, density, shape, constitution, etc., especially the method used by de Broglie, Meituer, Ellis and others in evaluating the quanta of the high-powered gamma rays from radioactive products.

The new theory of energy levels within the nucleus was outlined, with the evidence in favor of it.

280th Meeting, April 21, 1925.

R. E. COKER. Some Observations on Protozoa.

Formation of shell by Peranema. In a "wild" culture there were observed: (1) many minute colorless protoplasmic bodies (12—23μ) of irregular and variable forms and offering no features of recognition other than occasional traces of an eyespot and form-changes suggestive of a euglenoid relationship; (2) numerous symmetrical dark-colored ovoid shells (24—27μ), finely sculptured with spiral beaded lines. After protracted observation, one of the colorless bodies was observed to assume the form of a Peranema, with active flagellum and bright eyespot. Figures were given to show how this elongate and distinctly asymmetrical Peranema converted itself quickly into first a heart-shaped, then an ovoid form of perfect symmetry, and immediately surrounded itself with a fairly thick spirally beaded shell. Flagellum and eyespot were retained for a time, and a large vacuole was in evidence. The shell was at first perfectly clear but gradually darkened.

Choanoflagellates of the genus Codosiga. These minute collared protozoans were attached, with usually 2 or 4 individuals to a stalk. While the slender rigid stalk admitted of incessant mechanical vibrations, observation of a colony during a period of about 2 hours revealed no change of form or of relative position of an individual, no shifting of position of vacuoles or of light-refracting bodies, no external movements other than a continual waving of very delicate flagellum. In contrast, and suggestive of a high rate of metabolism, were the frequent contractions of 2 relatively large vacuoles, symmetrically placed, strictly alternate in action, and with a periodicity of one contraction in about 9 seconds.

There were illustrated the changes in appearance of a small ameba that when first noted displayed a typical *radiosa* form. Apparent fusion of pseudopodia occurred to form a broad and extremely thin ectoplasmic sheet of fluctuating outline. Throughout a long period of observation the body of granular cytoplasm showed no notable changes of size or form; meantime the outline of the ectoplasmic sheet changed so incessantly and rapidly, with such a flame-like action, as to suggest that the particular character of its movements were the result of the play of molecular forces between ectoplasm and environment, rather than that they were merely incidental to the assumption of a locomotive or trophic form.

Observations on *Ameba proteus* were reported in close harmony with Mast's recent illuminating account of locomotion in Ameba. An inner core of liquid cytoplasm flows in the direction of movement of Ameba, being sur-

rounded above, below and on the sides by a semi-solid motionless layer, which is constantly liquifying and falling into the stream posteriorly, while the streaming protoplasm solidifies marginally in the advancing pseudopodium without backward flow other than a slight "settling" of granules (a backward movement of 5μ, at most, in an Ameba 300μ in length. The outermost layer (plasmolemma), though separated from the streaming inner cytoplasm by a motionless layer, advances, as observed, at a somewhat slower rate than the inner stream, but with a force sufficient, not only to cause currents in the water, but to dislodge external objects offering evident resistance. In consideration of locomotion in Ameba, emphasis is frequently laid upon the "streaming of the endoplasm," but perhaps emphasis should rather be laid upon the movement of the plasmolemma, with which locomotion seems to begin. It is suggestive, at least, to think of the actively moving outer layer as possibly a distinctive organ of locomotion, as much so as the cilia or the flagella of other kinds of protozoa; then to inquire to what extent the conspicuous flow of granular plasmosol is a secondary but essential feature of the coordinated activity of the organism in locomotion.

E. V. KYSER (with C. R. WHITEHEAD and H. AMIN). The Inhibitory Action of Antiseptics on the Activity of Pepsin.

A study was made of the effect of various antiseptics on the peptolytic action of pepsin when added in the amounts usually given as an average oral dose. The classification of the antiseptics and the antiseptics used are those classified by Potter as follows: Strong Antiseptics; Corrosive Sublimate; Formaldehyde; Hydrogen Peroxide; Silver Nitrate; Gold Chloride; Zinc Chloride; Copper Sulfate; Iodine; Potassium Permanganate; Carbolic Acid; Creosote; Chloroform; Thymol; Menthol; Alum; Tannin; Acetanilid; Antipyrin.—Moderate Antiseptics; Boric Acid; Chloral Hydrate; Ferrous Sulfate; Zinc Sulfate; Arsenic; Quinine; Salicin; Sodium Salicylate; Salol; Mercuric Iodide; Eucalyptol; Sulphurous Acid; Zinc Sulfocarbolate; Bismuth Subgallate; Resorcinol.—Feeble Antiseptics; Benzoic Acid; Sodium Borate; Sodium Bicarbonate; Calcium Chloride; Sodium Chloride; Barium Chloride; Strontium Chloride; Ammonium Chloride; Ammonium Sulfate; Alcohol; Sodium Hyposulfite; Potassium Chlorate; Potassium Iodide; Glycerin.

The method followed was that of the U. S. P. IX for determining the peptolytic value of pepsin. The antiseptics were added directly to the egg albumen and two control samples, one with pepsin and without antiseptic, the other with antiseptic and without pepsin, were run with each determination. The results obtained were tabulated to show the gms. and per cent. of pepsin and antiseptic, the per cent. of the unchanged albumen and the per cent. of inhibitory action.

281st Meeting, May 14, 1925.

J. W. LASLEY. Some Hyperboloids of the Flecnode Suite. (Abstract appears on page 58.)

W. F. PROUTY. Relation of Rock Character and Structure to Topography in the Central Belt of the Folded Appalachians. (Illustrated.)

The area studied lies between the Allegheny Front in West Virginia and the eastern boundary of Hardy County, West Virginia, along the Virginia border. It is roughly about 30 miles square. In it are exposed sandstones, shales and limestones ranging in age from the middle Ordovician to the Mississippian. These have an aggregate thickness of about 14,000′.

In this section there are three horizons of sediments which are very resistant to erosion and which constitute relatively competent portions. These are the Medina sandstones near the bottom of the geological column, the Oriskany sandstone near the middle of the column and the Pocono sandstone near the top of the column. All the higher elevations in the area studied are held up by one or another of these three resistant horizons. The long and narrow ridges are usually the outcropping edges of these layers. The broad-topped and steep-sided elevations are usually synclinal mountains and the rather regular dome-shaped or canoe-shaped mountains are anticlines, whose surface rock is sandstone which has not as yet been pierced by the agents of erosion.

The eastern portion of the area studied has beautifully developed anticlinal valleys, similar to the ones so common in the southern Appalachian Mountains where erosion has passed by the heavy sandstone beds in its downcutting, and is now wearing its valleys in the Ordovician and Cambrian shales and limestones. Just west of the Virginia border are three deeply eroded anticlinal valleys in the Ordovician shales. These are surrounded by the mountains formed from the steeply inclined Medina sandstones.

In the central portion of the area the chief heights of land are sustained by the Pocono sandstone in the centre of synclinal folds.

Toward the western portion of the area, where the erosion has removed the higher group of sandstones and where erosion has not as yet cut through the lower sandstone group, we have the most varied conditions. In the Moorefield Valley and the area immediately to the west, are many fine examples of perfect anticlinal hills. These occur best where the Oriskany sandstone arches lose their Marcellus black shale covers by erosion. In these arches, as erosion continues, the Oriskany sandstone in the central portion of the arch is worn through and the underlying shales quickly develop into valleys. As these valleys continue to grow deeper, erosion is finally checked by the very resistant Medina sandstones. This sandstone gradually rises to form a mountain as the easily eroded shales and limestones about it are eaten away by the greater erosion on their outcrop. We have thus the changing conditions in the same structure from an anticlinal hill to an anticlinal valley and back again to an anticlinal hill, and with the piercing of this bottom sandstone a return to the anticlinal valley.

The writer has never seen a locality in the Appalachian Region in which topography so minutely reflects the structure and rock character as it does in the area about Moorefield. Elkhorn Mountain Anticline emerges from the valley level in the Oriskany sandstone arch, which rises gradually toward the southwest. This sandstone forms the crest of the gradually rising mountain. At a

point about four miles south of the northern terminus, the sandstone arch is completely eroded from the center of the arch. If the axis of the anticline is followed toward the southwest, it will be seen that the elevation drops off rapidly in the limestone and shale formations underlying the Oriskany, until, at a point about two and a half miles beyond the Oriskany outcrop, the erosion has eaten completely through the soft formations and the Medina sandstone is brought up by the increasing elevation of the arch. The surface rises from here to the southwest until the crest of the arch is reached. From this point on to the southwest the topography is repeated in reverse order to that in the northeast half of the anticline.

In a panoramic picture of Patterson Creek Mountain Anticline one can identify the structure from the topography. This mountain has been less deeply studied than Elkhorn Mountain, but structurally it is much more complex. There are several minor cross-folds in the anticline with corresponding areas of greater axial elevation. In each of these latter areas of greater axial elevation erosion has succeeded in piercing the Oriskany sandstone and has eroded deeply into the underlying limestones and shales, thus giving a depression in the mountain corresponding to the arching of the strata. In a similar way in the minor cross synclines or low places in the structure, erosion has not yet pierced the sandstone and as a result such positions are highly elevated.

In geological mapping much time and labor in field work can be saved by a careful study of the relationship between the topography rock character and structure and erosion.

THE PHILOLOGICAL CLUB

The Philological Club numbered over ninety members during the academic year of 1924-1925, an increase over the previous year. Of the seven meetings held, six were devoted to papers by members of the University faculty and the other to papers by visiting scholars. The complete program, with abstracts of the papers not appearing elsewhere in this bulletin, is given below.

November 4, 1924. NORMAN FOERSTER, "The Classic and Romantic Elements in Ralph Waldo Emerson."

The object of this paper was to show that Ralph Waldo Emerson, while in certain respects sympathized with the romantic mood of his age, was indifferent or hostile to the romantic writers, except Wordsworth, and he really belongs to classical tradition. Especially was he a follower of Plato. He urged doctrines of life and art that are fundamentally Greek.

December 2, 1924. H. D. LEARNED, "Old French Retention of the Latin '*a*' in Final Syllables."

Old French drops all vowels except "a" in final syllables of words derived from Latin. Latin "partem" becomes French "part"; Latin "portum" becomes French "port". But Latin "porta" is French "porte", retaining "e" where the old Latin "a" formerly existed. It was suggested that this may be due to the fact that the "a" was originally long in the endings of the first declension in Latin, but that the other vowels (in second and third declension endings) were short. Since nouns and adjectives form 75% of all words used, the treatment of their final syllables was probably extended to all other final syllables.

G. A. HARRER, "D. Martion Fosco, and the Supposed Discovery of the Lost Books of Livy."

A review of the details of the supposed location of the lost books of Livy by the Italian scholar, D. Martion Fosco. Clippings were read from newspapers of the past summer, recalling that Professor Fosco at first made certain reserved statements about the finding of the manuscripts, later stated pointblank that he had found them, and announced that his earlier reticence had been an effort to keep the rumor from spreading until he should have been able to sell copy rights, and then to dispose of the manuscripts themselves for a considerable sum. Official investigation revealed that Professor Fosco had *not* found the manuscripts, but merely a clue to their location, a clue that had been many times investigated, but had never led anywhere. So that the Italian professor's remarkable "find" in the cellar of the old monastery-fort led him into a cul-de-sac.

January 13, 1925. OLIVER TOWLES, "An Unpublished Manuscript of Octovien de Saint Gelais".

The following points were discussed in this paper:

1. A sketch of the Ecole des Rhétoriqueurs.
2. The position of Saint Gelais in this movement.
3. Description of the Ms. Fr. Nouv. Acq. 1158 of the Bibliothèque Nationale.
4. Separation into its various parts of the group of patriotic poems contained in folios 1 to 59.
5. Historical references and some of the literary sources of these poems.
6. Peculiarities of versification and vocabulary, and stylistic tricks of the group as a whole and of Saint Gelais in particular.
7. Originality of Octovien de Saint Gelais.

February 3, 1925. EDWIN GREENLAW, "Spenser and the Idea of Progress."

Harvey, as the secretary of a group, addresses a letter to Spenser in which he introduces three themes which are constant in Spenser's poetry. The topics appear to have been introduced, as "a new complaint of the new world", in a letter written by Spenser and read by Harvey to the group. In his reply, Harvey attacks Spenser's preference for a golden age of the past, and his complaint of present conditions; ridicules his theory that reason rather than

individual whim should govern action; and holds that since manners and codes change with the seasons, a man of the world should accept these changes and adapt himself to them. Evidence is at hand proving that these views were constant with Harvey; his philosophy is thus seen to be at variance with Spenser's. For while the "Faerie Queene" and much of Spenser's other poetry is intimately related to the time, his method is to test men and measures by his ideal of the antique age. He subscribes not only to the idea of human degeneration from the golden age, but to the doctrine of the decadence of nature that became a constant theme in 17th century literature, and was directly opposed to the idea of progress. So also his exaltation of reason, the rational principle in the soul, indicates the same point of view that is drawn directly from Aristotle and other Greek thinkers. This is the theme of the Book of Guyon; it reappears elsewhere in his work. Finally, Harvey's statement of mutability, which is accepted and enlarged upon by Spenser, is nevertheless used not to argue conformity but as the basis for the now familiar idea that modern things are to be tested by being "macht with plaine Antiquitie". The essence of his allegory is thus seen to be its use as a means for testing present conduct by what he thought to be ancient standards. In this he illustrates one of the three ideas in Professor Bury"s definition of the idea of progress, for he believes in the present value of the achievements of earlier times.

March 3, 1925. JAMES FINCH ROYSTER, "An American Dialect Dictionary".

April 7, 1925. N. I. WHITE, of Duke University, Durham, N. C., "The Development of Shelley's Reputation".

It has been the general impression that during his lifetime Shelley received little attention from reviewers, except for several vigorous attacks, and that for seven years after his death in 1822 he was practically unknown. Both these impressions are shown to be misleading when viewed in the light of the bibliography on which this paper is based.

This bibliography is a list of all the publications by or about Shelley which the writer could discover or to which he could find reference, and covers the period 1810-1842. It includes novels, poems, reviews, authorized and pirated editions, etc. There are 311 titles, 79 of them hitherto unreported in bibliographical works dealing with Shelley. Arranged chronologically, they furnish a conspectus of the development of Shelley's reputation.

The general notion of Shelley's obscuration from 1822 to 1829 has some foundation in Mrs. Shelley's difficulties in finding a publisher for the 1824 volume, the story of Browning's difficulties in finding Shelley's works, and the total ignorance of Shelley displayed by the Oxford debaters in the 1829 Oxford-Cambridge debate on Shelley and Byron. Yet in this very period Shelley's reputation was decidedly vital in certain quarters, as shown by the fact that there were six pirated reprints of various of his works and that one of the principal pirates, Benbow, advertised an engraving of the poet, together with the publication of all his works.

The bibliography shows 37 items for 1832, more than three times the number (12) for 1826 and 1829, thus showing that the real Shelley revival came in 1832, and not in 1829 as Forman and others have supposed. It shows also that during the last three years of his life Shelley received much more notice than at any previous time, and was rapidly coming into public attention. Among the items for these years five reviews of the *Cenci* are added to the five previously noted and three of the *Prometheus Unbound* to the three previously noted. For the first time it becomes evident that the two poems in question received almost as much favorable as unfavorable contemporary criticism.

A consecutive study of the 17 notices of Shelley in Blackwood's Edinburgh Magazine from January 1819 to December 1832 shows that until Shelley attacked Keats' reviewers in Adonais, Blackwood's was an earnest admirer of Shelley's genius while condemning his principles, and that this magazine sincerely strove to induce Shelley to accept established religious and social views. Not until after Shelley had published Adonais did Blackwood's give up the attempt to convert him; henceforth until after Shelley's reputation began to revive it spoke of him with unmixed contempt.

The gradual development of Shelley's reputation after his death owes a great deal at first to the radicals and to a small personal following, then to Shelley"s connection with Byron, to the romantic appeal of certain elements in Shelley's life and character, and to the growth of liberal sentiment in England, particularly the growing influence of newly established liberal journals.

R. P. McCUTCHEON, Wake Forest College, Wake Forest, N. C., "John Dunton, Seventeenth Century Reviewer."

John Dunton, who is best known as the founder of the *Athenian Mercury,* was, as a publisher, interested in several ventures in book-reviewing. These ventures include the *Supplements to the Athenian Mercury,* the *Young Student's Library, The Compleat Library,* and *The Post-Angel.* In these various journals were mentioned a fair number of literary works of the late 17th century. In them, one sees clearly the influence of the publisher himself, since books printed for Dunton are given the most favorable treatment possible. It is evident that frequently the publisher himself wrote the reviews, and it is also plain that he even wrote reviews of books which he himself had composed. He was the first English publisher to make a journal of books his own advertising organ.

May 5, 1925. W. D. MACMILLAN, "Planché's Extravaganzas".

An abstract of a doctoral dissertation with illustrative material to show the method and point of view of the study. See page 45.

THE GRADUATE CLUB

The first meeting of the Club was held at Phillips Hall, Friday, September 26, 1924. At this meeting Dean Greenlaw outlined the purposes of graduate study, and Dr. L. R. Wilson explained the facilities of the library for research work. The following officers were elected: George E. Newby, president; Lillie Cutlar, vice-president; F. T. Thompson, secretary.

During the year the Club held four additional meetings. At the November meeting Dr. Venable and Dr. Odum dealt with methods of research.

Dr. Venable drew upon his personal experience to show that different methods lead to the same end. He emphasized the necessity of investigation, disinterestedness, accuracy, patience, and verification.

Dr. Odum began by accepting the validity of the scientific method of research, and stressed the need of applying this method to research in the social sciences. In seeking for an objective method to study social forces Dr. Odum said the sociologist makes use of the following methods: comparison, analogy, induction, deduction, and *a priori.*

At the January meeting of the Club Mr. Williams and Dr. Booker gave short talks on research work in Europe.

Mr. Williams distinguished between the different degrees given at Oxford, and showed how they varied from those given on the continent and in America.

Dr. Booker gave his reminiscences of the Imperial Universities of Germany. He dwelt briefly on German University administration, the conduct of graduate seminars, and the German oral examination for the doctor's degree, pointing out in each case how these differed from American practice.

The March meeting of the Club was a memorial to the late Dr. T. S. Graves. Following a short biographical sketch by Mr. Hibbard, Dean Greenlaw presented an eloquent appeal for "Scholarship."

He briefly reviewed the method of scholarship used in the various departments of the University. He stressed the point that pure scholarship is not concerned with the immediate results obtainable, though very often these results may revolutionize society. Scholarship is a disinterested quest for knowledge and must be related to man's thirst for immortality.

At the April meeting of the Club Dr. E. W. Knight presented a paper on "Some Qualifications for Teaching."

He pointed out the mediocrity of much of our research for the attainment of advanced degrees, and stressed the increasing need of interpretative scholarship. Dr. Knight said that for those considering teaching accurate scholarship is necessary, but that the necessity of developing a well-rounded personality must not be forgotten. The teacher should at all cost avoid acquiring the "academic mind."

SOCIETY OF THE SIGMA XI

The University of North Carolina Chapter of the Society of the Sigma Xi (the Society for the Promotion of Research) was, until last year, the only chapter of this Society in the South. That the Chapter was established at the University is outstanding recognition of the national reputation of the University in the fields of science.

During the past year three general meetings have been held, to which members of the Society resident in other institutions in the state have been invited. At the first meeting Dr. Edwin Greenlaw presented a paper describing his studies in medieval scientific writings. At the annual meeting of the Chapter new by-laws were adopted, five active and four associate members were elected, and new officers were elected. At the commencement meeting of the Chapter the new members, as elected at the previous meeting, were initiated. Following his initiation as alumni member, Dr. J. B. Murphy of the Rockefeller Institute for Medical Research gave a most interesting account of his studies on cancer.

The Annual Sigma Xi Lectures were delivered May 18 and 19 by Dr. John J. Abel of Johns Hopkins University on "The Importance of the Apparently Negligible in Biology and Medicine." Dr. Abel dealt primarily with what are known as hormones, or the chemical messengers of the animal body and with several of the more important hormone-producing organs, the so-called organs of internal secretion and the role played by them in health and in disease. In addition he referred briefly to other allied chemical principles which like the hormones themselves are effective in negligible quantities, such as vitamins and growth principles, or trephones.

RESEARCH PUBLICATIONS

Contents of the research publications of the University during the period covered by this bulletin are as follows:

Journal of the Elisha Mitchell Scientific Society, Vol. 40

August, 1924

The Brownian Movements. *F. P. Venable.*

Notes on the Opiliones of the Southeastern United States, with Description of New Species. *C. R. Crosby and S. C. Bishop.*

Some Observations on Spore Formation and Discharge in Leptolegnia, Achlya, and Aphanomyces. *J. N. Couch.*

Notes on Woody Plants. *W. W. Ashe.*

The Mycenas of North Carolina. *H. C. Beardslee and W. C. Coker.*

December, 1924

Proceedings of the Twenty-third Annual Meeting of the North Carolina Academy of Science.

Proceedings of the Elisha Mitchell Scientific Society, October 9, 1923, to May 13, 1924.

The Science of the Future and for the Future. *Charles M. Heck.*

Improvements in the High School Science Situation. *J. Henry Highsmith.*

A Non-mathematical Interpretation of the Theory of Relativity. *W. W. Wood.*

New Megachilid Bees. *Theodore B. Mitchell.*

The Water Dogs *(Necturus)* of North Carolina. *C. S. Brimley.*

Amoeboid Behavior of the Lymph Cells in Sea-Urchins. *H. V. Wilson.*

A Simple Apparatus and Method for the Injection of Early Chick Embryos. *W. R. Earle.*

Variation of Protein Content of Corn. *H. B. Arbuckle and O. J. Thies.*

Opportunities for Chemical Industries in North Carolina. *E. E. Randolph.*

Some Observations upon the Reproductive Rate of Euglena Tripteris and Eudorina. *Bert Cunningham and Carrie Hearne.*

"Keeping Up" with Lantern Slides. *Bert Cunningham.*

The Loess Deposits of China. *Collier Cobb.*

Revision of the Genus Thraustotheca, with a Description of a New Species. *W. C. Coker and J. N. Couch.*

A Bibliography of Fishes. A Review. *R. E. Coker.*

Studies in Philology

Volume XXI, 3—July, 1924

Russell, Frances Theresa—Gold and Alloy.

Wedel, Theodore O.—Benedetto Croce's Theory of Aesthetic Criticism.

Tilley, M. P.—Pun and Proverb as Aids to Unexplained Shakespearean Jests.

Fletcher, Harris—Milton and Yosippon.
Metzenthin, E. C.—The "Heliand": A New Approach.

VOLUME XXI, 4—OCTOBER, 1924

Harrer, G. A.—The Site of Cicero's Villa at Arpinum.
Coulter, Cornelia C.—Latin Hymns of the Middle Ages.
Lawrence, W. J.—John Kirke, the Carolina Actor-Dramatist.
Shipley, Joseph T.—Spenserian Prosody: The Couplet Forms.
Snyder, Alice D.—Coleridge's Cosmogony: A Note on the Poetic "World-View".
McCutcheon, R. P.—The "Journal des Scavans" and the "Philosophical Transactions of the Royal Society".
Vogt, G. McG.—Richard Robinson's "Eupolemia" (1603).
Greenlaw, Edwin—The Return to the Classics.

VOLUME XXII, 1—JANUARY, 1925

Clark, Harry Hayden—The Literary Influences of Philip Freneau.
White, Newman I.—Literature and the Law of Libel: Shelley and the Radicals of 1840-1842.
Shackford, Martha Hale—"Hyperion".
Howell, Almonte C.—Sir Thomas Browne and Seventeenth-Century Scientific Thought.
Nethercot, Arthur H.—The Reputation of the "Metaphysical Poets" during the Age of Johnson and the "Romantic Revival".

VOLUME XXII, 2—APRIL, 1925

(Memorial Number to Professor Thornton Shirley Graves)

Tannenbaum, Samuel A.—Shakspere's Unquestioned Autographs and the Addition to "Sir Thomas Moore".
Emerson, Oliver Farrar—Shakespearean and Other Feasts.
Graves, Thornton Shirley—Women on the Pre-Restoration Stage.
Blanchard, Harold S.—Imitations from Tasso in the "Faerie Queene".
Covington, Frank F., Jr.—Spenser and Alexander Neckam.
Withington, Robert—"F. S., Which is to Say . . . "
Cawley, Robert Ralston—Drayton's Use of Welsh History.
Bush, Douglas—Classical Lives in "The Mirror for Magistrates".
Mustard, W. P.—Notes on John Lyly's Plays.
Graves, Thornton Shirley—Recent Literature of the English Renaissance.

THE NORTH CAROLINA LAW REVIEW

VOLUME II, 4—DECEMBER, 1924

Formation of Simple Contracts, *Merton L. Ferson.*
The Life and Influence of John Manning, *William J. Adams.*

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Chief Justice Shepard and His Times, *Robert W. Winston.*
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New Values in Legal Education, *William Reynolds Vance.*

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THE JOURNAL OF SOCIAL FORCES

VOLUME II, 5—SEPTEMBER, 1924

The Study of Cases, *Franklin H. Giddings.*
Roads to Social Peace: II, *Edward Alsworth Ross.*
Cotton and Southern Civilization, *R. Clyde White.*
Prohibition and Statistics, *Stuart A. Rice.*
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Social Work and Societal Engineering, *Franklin H. Giddings.*
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Exploration and Survey, *Franklin H. Giddings.*
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Woodrow Wilson: A Challenge to the Fighting South, *Gerald W. Johnson.*
The Objectives of Social Work Education, *Neva R. Deardorff.*
Judge Longstreet of Georgia, *John Donald Wade.*
Economic Factors in the Making of the Criminal, *John L. Gillin.*

VOLUME III, 3—MARCH, 1925

Three Aspects of a Social Situation, *E. C. Hayes.*
The Objectives of Social Work Education, *J. L. Gillin.*
Eugenics and the Social Good, *Warren S. Thompson.*
The Relation of Sociology to Social Work, *W. J. Karpf.*
The Spirit of Revolt in Current Fiction, *Julia Collier Harris.*
Essays in the Economic Interpretation of History, *A. W. Calhoun.*
Fads and Fancies in the Social Sciences, *Lorine Pruette.*

VOLUME III, 4—MAY, 1925

Are Human Movements Independent of Wars? *William Allen White.*
A Theory of Synchronous Culture Cycles, *F. Stuart Chapin.*
The Relation of Sociology to the Science of Education, *I. W. Howerth.*
Feminism and the Economic Independence of Woman, *Guion Griffis Johnson.*
The Concept of Progress: II. The Metaphysical Stage, *L. L. Bernard.*
William Graham Sumner: Sociologist, *Harris E. Starr.*
American Millionaires and Multi-Millionaires, *Pitirim Sorokin.*

In addition to the leading articles, the *Journal* printed more than two hundred contributions in its other departments.

Index

Page

Abel, J. J. 96
Abernethy, J. R. 59
Adams, A. B. 70
Adams, N. B. 69
Adams, R. W. 24
Amin, H. 63, 64, 89
Anatomy, Department of 5
Andrews, N. 27
Anscombe, F. C. 54
Ariail, J. M. 4, 42
Atkins, W. E. 17
Atkinson, M. 24
Babb, C. C. 14
Barnette, W. 54
Bell, J. M. 6, 86
Biddy, O. D. 62
Bird, C. R. 21
Bird, W. E. 21
Bost, R. W. 7
Botany, Department of 5-6
Boysworth, M. 75
Bradshaw, F. F. 82
Brandon, W. P. 55
Branson, E. C. 71
Braune, G. M. 12
Brooks, F. P. 7
Brown, C. K. 84
Brown, R. E. 76, 84
Brown, R. M. 75
Browne, E. T. 59
Byrd, R. M. 10, 11
Cain, W. 13, 87
Caldwell, W. E. 53
Cantey, H. 13
Carr, I. N. 55
Carroll, D. D. 16
Carson, B. G. 9
Casey, L. R. 20
Chemistry, Department of 6-12
Civil Engineering, Department of 12-15
Classical Languages and Literatures, Department of 16
Cobb, C. 49, 86, 87

Coker, R. E. 80, 88
Coker, W. C. 5, 87
Couch, J. N. 5
Covington, W. B. 28
Cox, C. 76
Crockford, H. D. 6
Cutlar, L. F. P. 7
Dashiell, J. F. 66
Daughterty, J. F. 66
Dearstyne, R. S. 13
Dickert, H. A. 10, 11
Duncan, S. 35
Earle, W. R. 81
Economics and Commerce, Department of 16-19
Edminster, L. C. 85
Education, Department of 20-32
Educational Research, Bureau of 20
Edwards, C. C. 60
Elisha Mitchell Scientific Society, Programs of 86
Elliott, P. L. 36
English, Department of 32, 49
Eutsler, R. B. 84
Floyd, J. H. 25
Foerster, N. 33, 91
Frazier, K. L. 70
Fulton, K. 77
Gaddy, C. F. 36
Geology, Department of 49, 52
George, W. C. 5, 87
Giles, W. E. 10
Gilreath, A. L. 63, 64
Glenn, W. D., Jr. 67, 84
Goodrum, F. S. 62
Graduate Club, Programs of the 94
Graves, T. S. 34
Greenlaw, E. 32, 92, 96
Green, E. L. 85
Green, F. M. 83
Green, M. 83
Hamilton, J. G. deR. 52, 83
Hampton, W. O. 24, 84
Harmon, A. O. 37
Harrer, G. A. 16, 92
Harris, C. R. 8
Harvey, J. V. 4, 6
Hearne, M. K. 17

Heffner, R. L. 38
Henderson, A. 57, 87
Herring, H. 84
Hickerson, T. F. 14, 87
Hinson, T. E. 17
History and Government, Department of 52-57
Holmes, H. M. 13
Howell, A. C. 35
Howell, E. V. 62, 63, 64
Hoy, W. E., Jr. 5, 87
Hoyle, V. A. 60
Hudson, J. P. 63
Huff, H. H. 73
Ingold, W. 25
Institute for Research in Social Science 82-85
Jenkins, W. S. 4, 56, 83
Jennings, E. DeW. 8
Jocher, K. 85
Johnson, A. T. 44
Johnson, G. B. 75, 85
Johnson, G. G. 83
Jordan, A. M. 25
Journal of the Elisha Mitchell Scientific Society, Contents of 97
Journal of Social Forces, Contents of 99
Knight, E. W. 20
Kyser, E. V. 10, 63, 89
Lasley, J. W. 58, 89
Lawrence, G. H. 75
Learned, H. D. 69, 91
Leavitt, S. E. 69
Lineberry, R. A. 12
Linker, W. M. 68
MacCarthy, G. R. 52
MacMillan, W. D. III. 45, 94
MacNider, W. deB. 61
MacPherson, D. A. 86
McCutcheon, R. P. 94
McGalliard, J. C. 38
McNeely, R. P. 63
McPheeters, R. A. 84
Marshburn, R. F. 24
Martin, O. E. 14
Mathematics, Department of 57, 61
Matherly, W. J. 16
Mebane, W. M. 10
Meyer, H. D. 75

Moore, C. E. 77
Moose, H. A. 62
Morgan, G. 21
Morse, M. 7
Murphy, G. M. 6
Murphy, J. B. 96
Muthiah, S. N. A. A. 18
Newsome, A. R. 53
North Carolina Law Review, Contents of 98
Odum, H. W. 74, 85
Padgett, J. B. 14
Patterson, A. H. 87
Patton, J. W. 56
Pegg, H. D. 25
Penney, J. T. 81
Personnel and Vocational Investigation, Bureau of 82
Pharmacology, Department of 61, 62
Pharmacy, School of 62-64
Philological Club, Programs of 91
Physics, Department of 64, 66
Plyler, E. K. 65, 87
Powell, C. P. 56
Presnell, W. C. 18
Privette, W. G. 25
Prouty, W. F. 50, 89
Psychology, Department of 66-68
Quinby, W. C. 10
Rayburn, H. L. 63
Reep, A. R. 29
Reeves, C. G. 19
Renegar, H. C. 30
Research Organizations 86-96
Research Projects 4
Research Publications 97-100
Rhyne, J. J. 78
Rogers, W. W. 68
Romance Languages, Department of 69-71
Royster, J. F. 93
Rural Social-Economics, Department of 71-73
Saville, T. 13, 14
Schaff, W. R. 20
Sessums, A. C. 39
Shine, W. H. 40
Sides, L. R. 22
Simkins, F. B. 53
Smith, E. G. 79

Smith, G. W. 13, 14
Sociology, Department of 74-80
Spivey, G. C. 40
Steiner, J. F. 74
Stone, O. 79, 85
Studies in Philology, Contents of 97
Stuhlman, O., Jr. 64, 86
Suggs, R. R. 10
Swartz, J. H. 50
Taylor, H. M. 7, 63
Terry, P. W. 25, 26, 27
Thompson, F. T. 47
Thrall, W. F. 34
Totten, H. R. 62, 63, 64
Towles, O. 92
Trabue, E. S. 40
Trabue, M. R. 20, 21, 23, 25
Tremain, R. L. 20
Trimble, R. M. 14
Trussell, B. 73, 83
Valentine, T. W. 27
Viele, A. B. 22, 23
Vilbrandt, F. C. 10, 11, 12
Wager, P. W. 83
Walker, T. T. 9
Waters, F. M. 25
Weatherly, C. H. 30
Weathers, C. L. 31
Webb, W. S. 41
Wheeler, A. S. 7, 8, 9
White, N. I. 93
Whitehead, C. R. 63, 89
Whitener, T. A. 82
Whitley, D. P. 25
Whitmire, H. E. 63
Willard, D. W. 85
Wilson, H. V. 80
Woodhouse, C. G. 84
Woodhouse, E. J. 83
Zoölogy, Department of 80, 81